Hilda Hanway

Imagination

DO WE not all understand, when we are reading a great story or a beautiful poem, that we have jumped up behind a genius, as it were, and that he is taking us for a ride on his winged horse, Imagination? And do we not also understand that if we ourselves had not a great imagination in our souls we could never enjoy that magic ride?

"Somebody has said that a child takes up a twig and calls it a king, and it is true that the imagination of a child is a supreme and wonderful thing. A child knows better than all the grown-ups in the world that this beautiful and romantic earth is not the real thing, that there is in fact a much more beautiful and much more romantic world all about us if we have eyes to see it and imagination to enter into it."

(See page 1737)

IMAGINATION

COMPTON'S PICTURED ENCYCLOPEDIA

VOLUME 4

*To inspire ambition, to stimulate
the imagination, to provide the
inquiring mind with accurate
information told in an interest-
ing style, and thus lead into
broader fields of knowledge—
such is the purpose of this work*

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CHICAGO

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CHICAGO
ILLINOIS

HERE AND THERE in Volume Four

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. Divided as it is into broad groups, it offers a fascinating variety of subjects for selection. With this as a guide, you may wander through storyland, visit far-away countries, meet famous people of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list contains, however, only a small proportion of the articles in this one volume, and is not intended to serve as a table of contents, an index, or a study-guide. For these purposes consult the Fact-Index and the Study Outlines at the end of this work.

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index in the last volume. Marked letters are sounded as in the following words: *cāpe, ăt, fär, fȧst, swạt, fa̤ll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, nŏt, fôr, wȯn, do̤; cūre, bŭt, düne* (French *u*), *rṳde, fụll, bu̇rn; ḡo, ġem, cañyon, Jeaṅ,* (nasal); G = German *g* (guttural); K = German *ch* (guttural).

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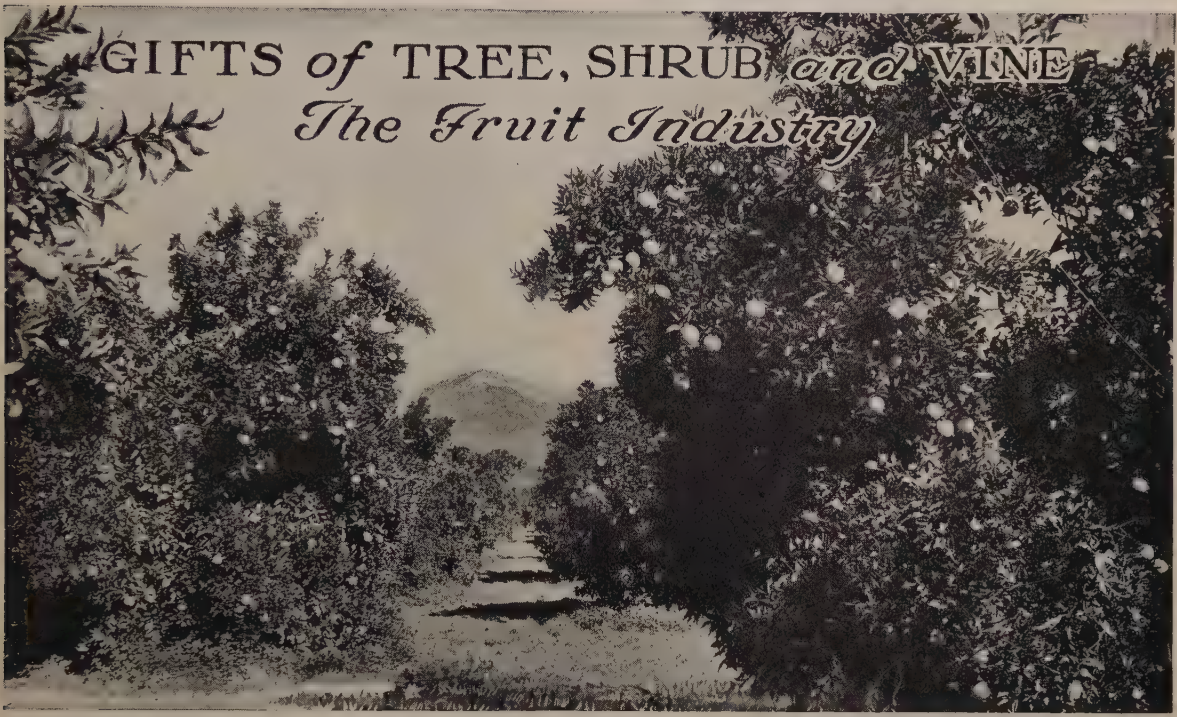
GIFTS *of* TREE, SHRUB *and* VINE

The Fruit Industry



FRUITS AND FRUIT GROWING. The fruits that we enjoy today in all their wonderful variety of choice flavors and attractive colors represent nature's gracious rewards for cultivation rather than her free gifts to man. Primitive man took what wild fruit the trees, shrubs, and vines had to offer, without bestowing any care in return. Practically every fruit of the temperate zone and many of the desirable fruits of the tropics grow today in North America but the American Indians had only a few varieties of crab-apples, and berries such as strawberries, mulberries, and huckleberries. Our modern fruit industry chiefly depends on the fruits which the white settlers brought from their homelands across the water—fruits that had been cultivated for hundreds and even thousands of years in Europe and Asia.

Fruits with tempting flavors highly developed, seedless, thin-skinned, and oversized fruit, and fruit stalks without spines or thorns—these are some of the marvelous changes due to man's experiments in fruit growing (*see* Burbank, Luther). Such results have been obtained in some cases by cross-fertilization between two species so that the desirable qualities of both are combined in one hybrid.

However, the seeds of hybrids and other choice varieties obtained by careful selection and cultivation will not usually run "true to type." Trees and shrubs grown from such seeds tend to go back to the form and habits of their wild ancestors. To overcome this difficulty, the process of grafting is used, by which a bud or twig of the choice variety of tree or shrub is made to grow from the roots or stem of a common or even a wild member of the same tribe. The bud or twig, called the "scion," is inserted in a cleft cut in the "stock plant," and the joint is then dressed and bandaged to protect it from the air. If this "plant surgery" is properly performed, the two will knit together and grow like broken bones when they are set by a physician. And the resulting "new" tree will bear the same fruit as its parent stock.

Great numbers of fruit seedlings are raised to provide the stocks on which choice cuttings are grafted in special nurseries. The combined stock and scion are then transplanted to the orchards.

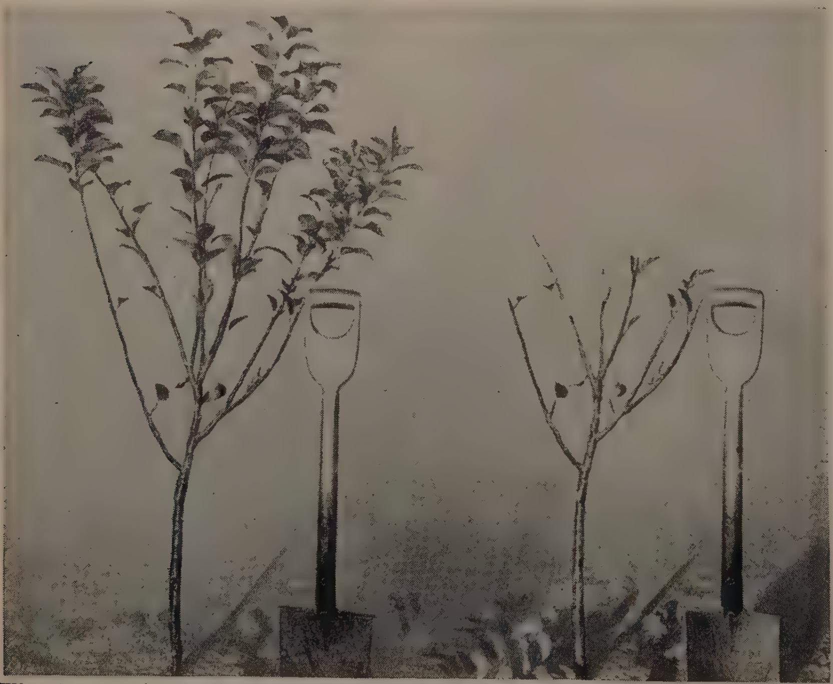
Great changes in the fruit industry have come about by refrigeration and rapid transportation (*see* Refrigeration). Previously apples were practically the only fresh fruit enjoyed in winter. Perishable fruit could be eaten fresh only in season and in the locality where grown. Now the fruits of the South are regularly shipped to the North when fruits there are not in season, and fruits of many kinds are kept in cold storage warehouses for winter use. Many American fruits are shipped to England and other countries, and in return various native fruits are brought from practically every country of the globe—melons from southern France, peaches grown in the hothouses of Belgium, and peaches, plums, and other fruits from South Africa. Fresh apples, lemons, bananas, and oranges are supplied throughout the year, while pears, strawberries, grapes, and peaches which a half-century ago were enjoyed only for a few weeks are now on the market many months. During the boyhood days of men now in middle age, bananas were a curiosity to be had only in large cities. They have become a year-round standby. So too our chief markets are now receiving the *avocado* or alligator pear, a fruit with smooth rich pulp which when ripe has a nutlike flavor, is very rich in fats, and can be spread on bread like butter; the mango (*see* Mango), and the sapodilla, the apple-shaped fruit of a large evergreen tree which also supplies the chicle used in making chewing gum.

PLANTING A FRUIT TREE

Young trees should be transplanted an inch lower than they were planted in the nursery. A board is used to gage the depth of the planting.

There are many other tropical fruits, however, which are as yet little known except in the areas where they grow or as they come to us as preserves of some kind. Such fruits as the *papaw* of the tropics, a fruit resembling a small cantalope very different from the banana-shaped fruit of the common American papaw; the *tamarind*, which has long brown-shelled pods containing a brown acid pulp used in making cooling drinks and marketed in sweet preserves; the *loquat*, a Chinese or Japanese fruit now cultivated in the Gulf States and resembling a yellow plum; the *cashew apple*, the fine-flavored fleshy stalk on which is borne the nut of the tree; *guava*, represented by the two varieties, red and white, one shaped like an apple and the other like a pear, the pleasantly acid pulp of which is made into guava jelly; *mangosteen*, a reddish brown fruit about the size of an apple and having white juicy pulp of delicate sweet and acid flavor; *cherimoyer* or custard apple, the small heart-shaped pulpy fruit of a little tree grown in Colombia or Peru; and the *star apple*, a West Indian fruit like an apple in size and appearance with a star-shaped center formed by the seed cells.

A YOUNG TREE BEFORE AND AFTER PRUNING



When trees are brought from the nursery, the tops should be cut back so that there will be a balance between the amount of top and the amount of roots remaining. Unless this is done transplanted trees usually do not get on well.

While we still have the small fruit garden, and the farm orchard of 50 or more trees, this wider distribution of fruits has developed commercial orchards spreading out over thousands of acres of irrigated land. Thousands of workers are employed on the large projects in picking, sorting or grading, packing, and marketing the fruit. The workers must know their trade and work with nimble fingers. The fruit, picked just at the right time, which is before it is ripe, is carefully handled, wrapped, and closely packed to prevent bruising which might cause the fruit to rot before reaching the market. In most of the fruit areas the grading, shipping, and marketing, even

THE BEST WAY OF WRAPPING ROOT GRAFTS

These pictures illustrate experiments made by the Department of Agriculture at Washington to determine the best method of wrapping root grafts. The materials used were cloth, rubber, waxed paper, plain thread, and waxed thread. One you see was left unwrapped and in another the union was waxed without wrapping. The conclusion from the experiments was that cloth is the best wrapping to use.

the advertising, is carried on by effective coöperative organizations. They strictly supervise the quality so that the reputation may be maintained and so enable them to market the product at the best rates for the producer.

Uncle Sam the Greatest of Fruit-Growers

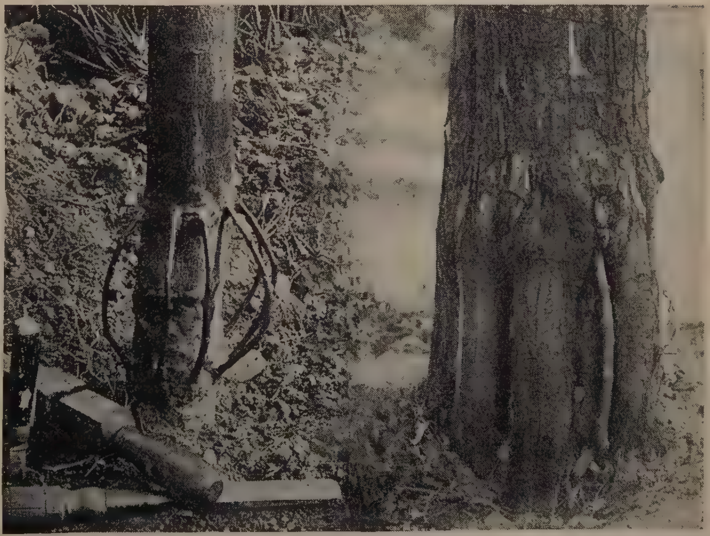
The United States is the leading fruit-growing nation both for quantity and variety of fruits grown, and the crop in some years is worth in the neighborhood of $500,000,000. Apples are the most important fruit crop and the most widely distributed, having been developed in a thousand varieties, some of them well adapted to growth in northern latitudes. California is far in the lead as a fruit state, shipping large quantities of oranges, lemons, peaches, pears, and grapes. New York, Pennsylvania, Ohio, Michigan, Illinois, and Indiana are other important fruit states, and irrigation is bringing new areas in the Southwest into the fruit belt. Washington, Oregon, Colorado, and Idaho furnish delicious apples, cherries, pears, and plums; Florida grows pineapples, oranges, grapefruit, and other tropical fruits; Colorado sends melons, and Georgia contributes peaches before the northern crops are ready.

Of the native fruits there are still to be found wild crab-apples, wild plums, and cherries. Berries, such as raspberries, strawberries, blackberries, and gooseberries, are found both cultivated and growing wild. Blueberries grow wild in a limited area and their cultivation has only been undertaken as an experiment on a small scale. Cranberries, which grow wild in cool climates, are extensively cultivated in some of the northern states. Elderberries and the scarlet haws or thorn-apples are little known, although the wild fruit is used for making jellies. The wild grape, papaw, and may-apple or mandrake are also found in the wildwood.

Starting and Caring for an Orchard

The fruit-grower chooses well-drained land for the orchard site, with good subsoil to a depth reached by the tree roots. The young trees grown in a nursery are set out in regular spaced rows in the orchard when they are one or two years old. The orchard is cultivated to keep out the weeds and sometimes cover crops such as clover or alfalfa are grown and then turned under to add nourishment to the soil.

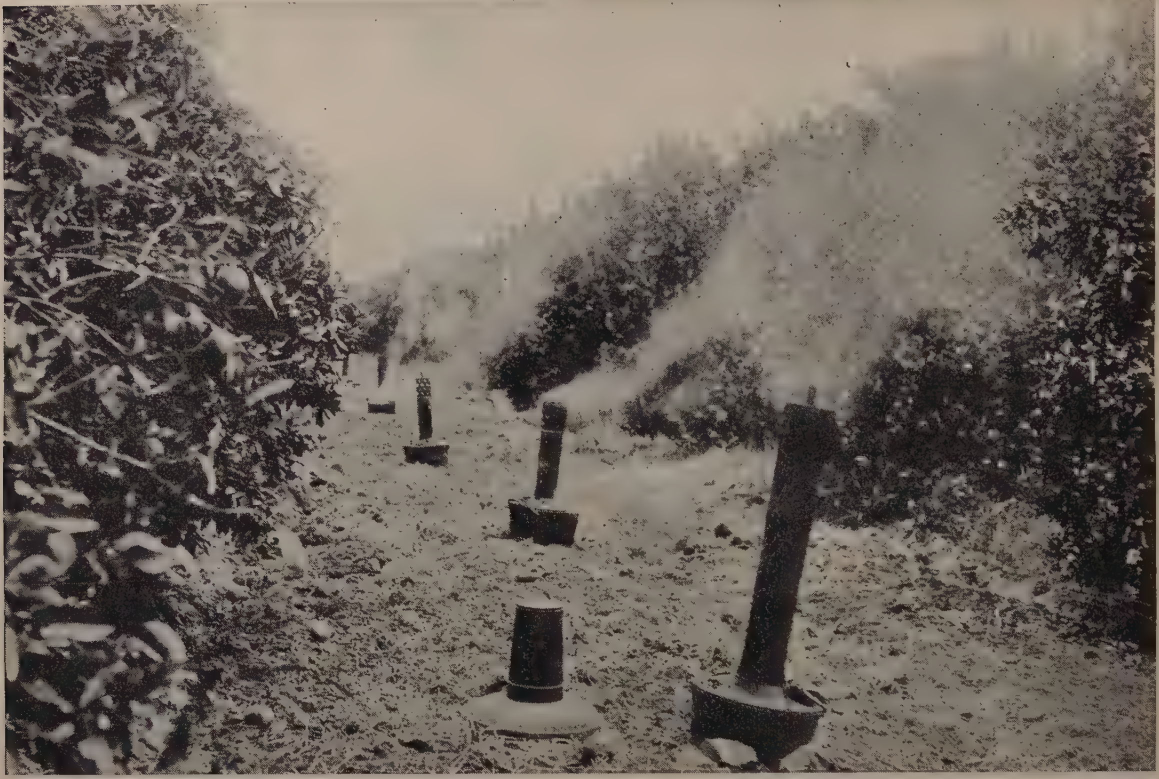
SAVING A TREE'S LIFE



Rabbits and other small gnawing creatures sometimes chew off a circle of bark around the base of a tree. When a tree has been "girdled" in this way, the sap cannot rise and the tree will die unless something is done quickly to save it. Here is one of the rescue methods, called "bridge grafting." The tree on the left is newly grafted. In a few years it will look like the tree on the right, for not only do the grafts carry the life-giving sap, but they grow along with the rest of the tree.

Another important operation in orchard and vine-

SMOKING JACK FROST OUT OF THE ORANGE GROVES



Even in the warm climates where oranges grow, the nights sometimes are cold and Jack Frost is liable to do a good deal of damage if precautions are not taken. Accordingly, little stove-like affairs, such as these, containing oil, coal, coke, or wood, are set through the orchard, and while the heat warms the atmosphere the smoke helps to form a protecting blanket.

yard is that of spraying to prevent injury to the tree or its fruit from insect or fungus pests (*see* Spraying). Pruning is also very necessary to good fruit. By a proper cutting back of wood growth, fruit-bearing wood may be given increased vigor and the tree opened up so the sunshine will reach the fruit. Pruning away dead branches prevents injury to the tree through spread of the decay, removes a natural harbor for insects and other enemies of the trees, and removes weight that would uselessly encumber the tree. Even old neglected orchards may be restored to bearing by proper pruning and care.

Fighting Off the Frost

Frost coming after the trees have begun to bud can do an enormous damage to the orchard (*see* Orange). When warning of an untimely frost is sent out by the weather bureau among the fruit-growers of any region, they act promptly to save their precious trees. Smudge fires are started all through the orchard forming a blanket of smoke overhead to prevent the loss of heat through evaporation during the night. For the same purpose a curtain of vapor may be formed over the orchard by spraying water high into the air, and still another method is to fill with hot water a system of pipes running all up and down the rows of trees to keep the temperature above the freezing point.

Fresh fruits, like green vegetables, contain large quantities of water, and are not substantial foods. Their great value lies in their aid to the digestion of other foods and in the desirable vegetable salts which they contain. Dried, preserved, and canned fruits hold a very important place in our diet (*see* Canning Industry; Dehydrated Food).

Fruits in the botanical sense are the parts of the plant which contain the seeds. To the botanist, the seed-carrying portions of all plants are fruit, even if we do not commonly think of them as such, so that we may name three main fruit classifications: (1) fleshy fruits, such as berries, oranges, melons, gourds, and apples, with seeds in the flesh; (2) stone or drupaceous fruits containing pits or stones, such as plums, peaches, and cherries; (3) dry fruits, including nuts, grains, legumes such as beans and peas, and capsules, pods, or similar containers such as the seed vessels of flowers. In the fleshy fruits, the whole seed envelop or *pericarp* is fleshy or juicy. In the drupes, the part of the fruit around the seed (the *endocarp*) becomes hard or stony, forming the peach or plum or cherry "pit," while the outer portion (the *exocarp*) is fleshy. Dry fruits may be divided into "splitting" fruits, like peas, beans, and poppy capsules, which break open and scatter the seeds, and "non-splitting" fruits, like acorns, grains, and nuts.

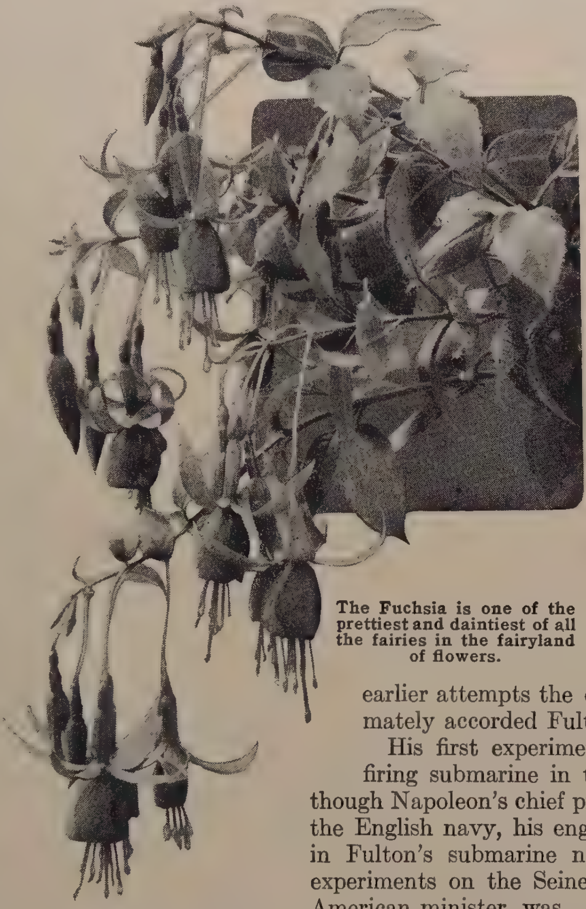
FUCHSIA. "What a beautiful plant!" exclaimed a London nurseryman as he entered a sailor's dwelling in the dock district. "Where did you get it?"

The sailor's wife smiled as she looked at the flower that had come from far-off Chile. "My husband brought it from foreign parts," she answered proudly.

The nurseryman recognizing it as one of the same rare plants that had been brought from South America that very year (1788) and placed in Kew Gardens, promptly bought it and procured from its cuttings several hundred plants which he sold for a high price. From these specimens and from others brought chiefly from Central America, Peru, and Chile have come the many plants whose brilliant drooping funnel-shaped blossoms of purple and rose and white make so gay a showing in our old-fashioned gardens and in our homes.

Careful cultivation, selection, and cross-pollination produce an almost unlimited number of interesting varieties. The nectar of the flowers contains an unusually large percentage of cane sugar, and the little four-celled berries are sometimes sweet and good to eat. From certain species a dye is obtained.

The fuchsias are a genus of plants of the evening primrose family (the *Onagraceae*) containing about 70 known species, mostly natives of tropical America. The common fuchsia or "ladies' eardrop" (*Fuchsia macrostemma*) has 4 light petals borne in the throat of a colored funnel-shaped calyx, 8 stamens projecting outside the corolla, and a 4-celled berry.



The Fuchsia is one of the prettiest and daintiest of all the fairies in the fairyland of flowers.

FULTON, ROBERT (1765–1815). When the first wholly successful steamboat, the *Clermont*, was launched on the Hudson River in 1807, Robert Fulton's old friends in Lancaster, Pa., probably were not surprised. They had always expected the quick-witted, ingenious Irish boy, who had grown up among them and had already won a name abroad by other inventions, to succeed.

This inventor of the steamboat was born on Nov. 14, 1765, on a farm in what is now Fulton Township, but the family soon afterwards moved to town and, the father dying, was left to a rather precarious manner of living. At 17 Fulton went to Philadelphia to work for a jeweler and study art. So well did he use his time and talents that at 21 he had $400 to invest in a farm for his mother and sisters before going to London to study art with Benjamin West.

But a lively-minded youth who earned $400 and bought a farm while studying painting evidently had practical qualities. English friends encouraged Fulton to turn engineer, and art was soon forgotten in the midst of a series of useful inventions of dredging-machines, flax-spinning and rope-making devices, and a substitute for canal locks.

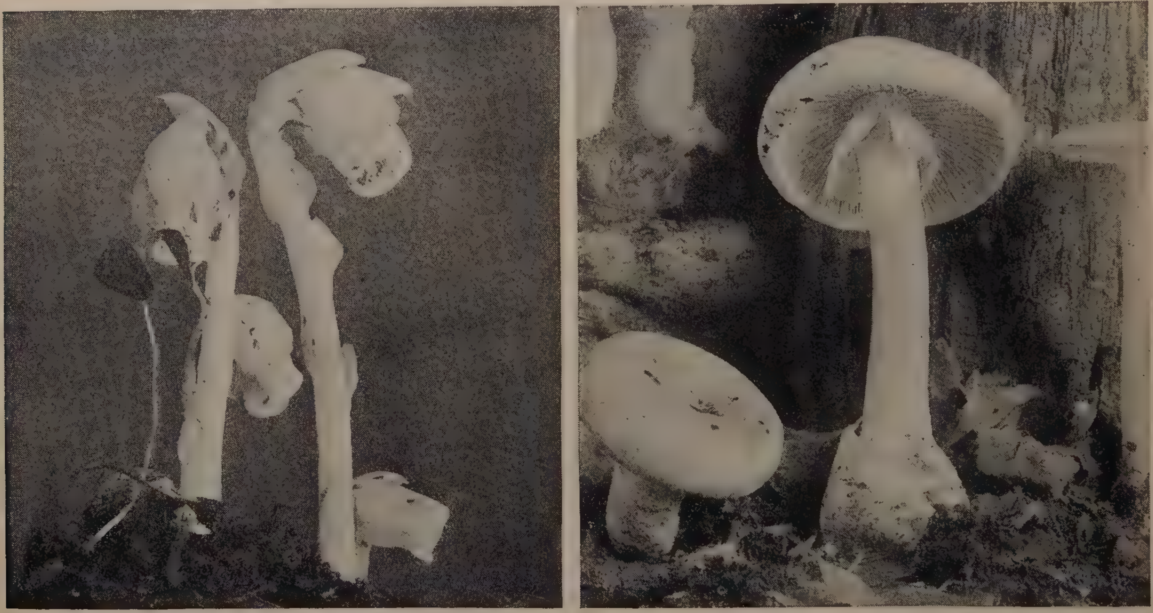
When many minds were thinking how steam-engines could be used to shorten distances on land and sea, it was not surprising that the American from the land of rivers, canals, and great distances turned his mind to the steamboat. He knew of the numerous experiments, some of them quite promising, that had been made by English and American inventors for a century before. A little more persistence or a little more support might have given any one of several earlier attempts the distinction which was ultimately accorded Fulton's experiment.

His first experiments were with a torpedo-firing submarine in the harbor of Brest. But though Napoleon's chief problem was how to combat the English navy, his engineers were not interested in Fulton's submarine nor in his first steamboat experiments on the Seine. Robert Livingston, the American minister, was. He had already been promoter of a company to run steamboats on the Hudson. Fulton returned to America as a partner of Livingston to work out a practical steamboat.

Robert Fulton succeeded where others failed, for he was shrewd, practical, determined, with a charm that won him friends and the necessary money for his plan. The scoffers might call his boat "Fulton's folly" or a burning sawmill on a scow. He knew it would work and it did. On Aug. 17, 1807, the *Clermont* with her English-built engine made her trial trip from New York to Albany—150 miles upstream—in about 30 hours. The craft created tremendous excitement and won immediate favor. In 1815 Fulton built for the United States the first steam warship. He was never wealthy and lawsuits about patents and overwork undermined his health. He died in New York City Feb. 24, 1815.

FUNGI (fŭn′jī). A large group of very simple plants, distinguished by the fact that they do not contain the green coloring matter (chlorophyll) possessed by higher plants, are known as *fungi*. This group includes all molds, mildews, rusts, smuts, yeasts, truffles, puffballs, toadstools, and mushrooms. Since they lack chlorophyll with which to manufacture their food out of raw materials, the fungi are compelled to live upon the food produced by other plants and animals. When they get their food from living creatures, fungi are called "parasites"; when they live on dead animal or vegetable matter, they are called "saprophytes." Parasitic fungi do a vast amount of harm in the world, causing diseases in men, animals, and plants. The saprophytes, on the other hand, do a great deal of good as scavengers.

THE "GHOST FLOWER" AND THE "DEATH CUP"



The plant on the right is the deadly Amanita or "Death Cup," one of the most poisonous members of fungus society. On the left is that strange plant called Indian Pipe or "Ghost Flower," which is often found growing in moist dark northern forests. While it is not classed as a true fungus, it looks and behaves very much like one, for it has no green coloring matter and gets its nourishment from the roots of other plants and from decaying vegetable mold.

Fungi range in size from the tiniest molds to the huge toadstools. Many varieties such as the lichens are eaten by wild animals. Some, like mushrooms and truffles, are highly prized delicacies for human food. Certain others are used for making drugs and dyes. Yeasts are among the most useful of all fungi.

Fungi are divided into three groups: *Phycomycetes*, such as black mold, downy mildews; *Ascomycetes*, such as mildews, truffles, cup-fungi, yeasts; *Basidiomycetes*, or rusts, smuts, mushrooms, toadstools, and puffballs.

FURIES. These avenging deities of Greek and Roman mythology were daughters of Night, or according to another myth they sprang from the blood of the mutilated Uranus when he was slain by his son Saturn or Cronos. The Greeks called them *Erinyes*, the "angry ones." They also called them *Eumenides*, the "well-minded" goddesses, probably because they feared to call such terrible beings by their true name.

Their number varied, but usually they were spoken of as three: Megaera (the grimly jealous), Alecto (the unwearied persecutor), and Tisiphone (the avenger of murder). Nothing, it is said, escaped their sharp eyes, as they pursued the evil-doer with speed and fury, permitting him no rest. A famous drama of the Greek poet Aeschylus deals with their pursuit of Orestes, son of Agamemnon, for the slaughter of his guilty mother Clytemnestra.

FURNACE. The type of furnace with which you are probably most familiar is that which heats the air or water or generates the steam by which houses and public buildings are warmed (*see* Heating and Ventilation). But there are also various types of furnace used in manufactures. These may be classified as furnaces in which the fire and the material to be heated are brought into contact—as in the blacksmith's forge, the blast furnace, and the cupola; furnaces in which the fuel is in one compartment and the substance to be heated in another—as in the reverberatory furnace used in making iron and steel; and furnaces in which the material to be heated is in a closed chamber or sealed retort heated by external flames, hot gases, or electricity—as in pot furnaces for making glass and crucible furnaces for making steel (*see* Glass; Iron and Steel).

Perhaps the most interesting type is the modern electric furnace, out of whose furious blasting heat have come some of the most amazing achievements of modern chemistry. With the aid of its tremendous temperatures—7,000° Fahrenheit and more, double that of the hottest furnace fed with ordinary fuel—we can melt platinum, chromium, tungsten, molybdenum, and other refractory metals from their ores. We can fuse quartz and blow it like glass to make flasks, retorts, and "pyrex" kitchen ware, which may be heated red hot and plunged into ice water without breaking. We can take carbon in one form, ordinary coal, and turn it into another form, graphite. Carbon and silicon are fused into one of the hardest substances known, carborundum, so much used for grinding and polishing metal. Carbon and lime are forced to unite to make calcium carbide, which we use to make acetylene gas. Phosphorus is stewed out of phosphate rocks, to be used in making matches. Most of the alloy steels, so indispensable to the automobile manufacturer and the maker of high-speed tools, are made in the electric furnace; and the electric furnace is being used more and more instead of the Bessemer and other processes in the production of iron and steel.

Most wonderful, perhaps, of all the miracles of the electric furnace is the fixation of atmospheric nitrogen. Enormous furnaces in which electric arcs are drawn out into great disks or spirals of flame are used to force the nitrogen and oxygen of the air to combine, forming nitric oxide, which is easily turned into nitric acid or nitrates for fertilizers and explosives.

There are several types of electric furnace, but they all consist essentially of a crucible of some non-conducting heat-resisting material, such as limestone, inclosing two carbon electrodes. When the current is turned on, an electric arc is formed between the electrodes. If the current, instead of passing through the air, is passed through a liquid, the furnace is of the electrolytic type; if through a solid, it is of the incandescent type.

FURNITURE *Making*—ANCIENT *and* MODERN

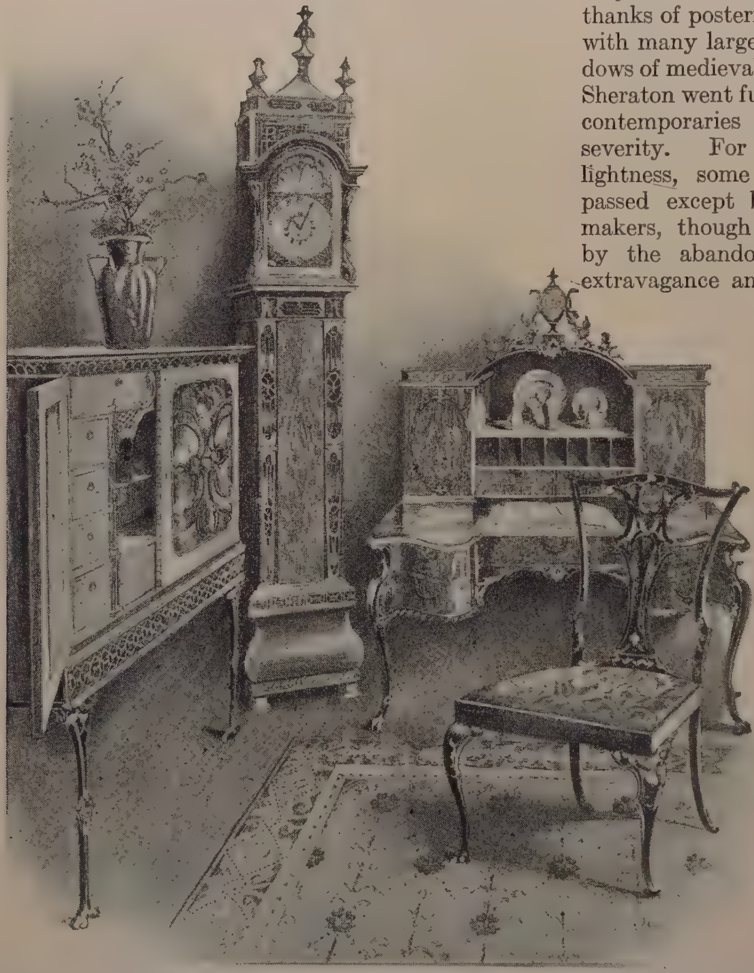
One of the greatest of furniture makers—Thomas Chippendale—is shown here working with an apprentice on one of the beautiful tables which made his name famous. This careful hand labor of the master craftsman has today been replaced by the speedier but less artistic work of whirring machines, as illustrated at the end of this article.

FURNITURE. The making of furniture distinguished for beauty and grace, as well as merely for utility, was once a handicraft which great artists did not feel to be beneath their dignity. Today, the invention of modern machinery has made it a factory process, in which fine individual workmanship is too often lacking. Accomplished artists are employed by manufacturers, it is true, to design furniture, but the substitution of the machine for the workman has robbed even the finest specimens of modern furniture of a great part of the artistic charm and personal touch which delight the collector of specimens made in earlier times. On the other hand, furniture-making is one of the most widely dispersed industries in the United States, with a combined annual output valued at about $300,000,000.

In ancient times and throughout the Middle Ages, houses were very scantily furnished. Chairs were reserved for the lord of the house and favored guests; stools and benches, chests for clothing, beds, and tables—which were often just boards laid across trestles—formed the greater part of the furniture. Egypt, Greece, Rome, and other ancient nations had elaborate pieces of furniture made of ivory, bronze, silver, and gold, and decorated with precious stones, but these were rare and belonged only to the great. The poorer classes had no furniture save of the meanest sort. The early Egyptians were adept in woodworking, and pictures on their tombs and some pieces that have been preserved indicate that they had wooden furniture, sometimes carved and gilded and covered with splendid textiles. The oldest known piece of furniture in the world, now in the British Museum, is a wooden throne of an Egyptian queen who lived 3,000 or more years ago. It shows considerable artistry and skilled handiwork.

The period of the Renaissance marks the first important development in furniture-making. Florence, Milan, Rome, and Venice became important centers of cabinet-making, and making the home a place of comfort and beauty was for the first time given serious consideration. In France, especially in the age of Louis XVI, in the last quarter of the 18th century, furniture of exquisite design was produced, decorated with carving, painting, inlaid work, and bronze and brass ornamentation. In England also the latter part of the 18th century—the mid-Georgian period—was the great period of achievement in furniture-making. Mahogany and satinwood took the place of oak, and grace and beauty of design, accompanied by skilled craftsmanship, marked the work of Thomas Chippendale, George Hepplewhite, Thomas Sheraton, and the Adam brothers, the masters whose work still stands as a model for furniture makers.

EXAMPLES OF CHIPPENDALE FURNITURE



Many think that Chippendale did his best and most characteristic work in the designing of chairs. But his designs of cabinets, cases for tall clocks, and writing desks, such as those you see in this illustration, are equally distinctive. His work was distinguished for delicacy and lightness of structure and exquisite carving.

Chippendale, the first and greatest of this group of artists, found English furniture for the most part merely a tasteless jumble of the various Continental and earlier English styles. He devoted his life to preaching the gospel of beauty in furniture, and producing chairs, tables, and other articles that were strong as well as handsome, useful as well as ornamental. Chippendale's work, reinforced by his famous book on furniture-making, revolutionized the whole trade in England. About the same time Robert Adam and his three brothers were doing an almost equally important work, in making the house and its decorations and furnishings an artistic whole. Though they were architects by profession, these men designed furniture of all types to fit the beautiful houses they created. The Adam brothers also deserve the thanks of posterity for being the first to build houses with many large windows, instead of the small windows of medieval times that still survived in England. Sheraton went further than any of his predecessors or contemporaries in the direction of simplicity and severity. For delicacy, harmony, balance, and lightness, some of Sheraton's designs are unsurpassed except by the best work of the French makers, though some of his later work is marred by the abandonment of his own principles for extravagance and fantastical forms. The foundations laid by this brilliant mid-Georgian school, and by the French artists, have been used ever since for the finest creations of the best furniture makers.

About the same time the simple and substantial colonial furniture began to be designed in America, establishing a vogue that extends to this day. Most of the early cabinet makers of America lacked any artistic training, and their furniture was heavy and unattractive. In 1815 the steam lathe was first applied to the making of furniture, and in 1825 the circular saw was invented. Furniture which formerly had been very plain was now covered with elaborate meaningless scroll-work and moldings, easily produced by the new machinery. Since 1859 most furniture has been made by machines, which cut, polish, and even assemble the articles. Some of the polishing of furniture is still done by hand, but there is very little individual construction work.

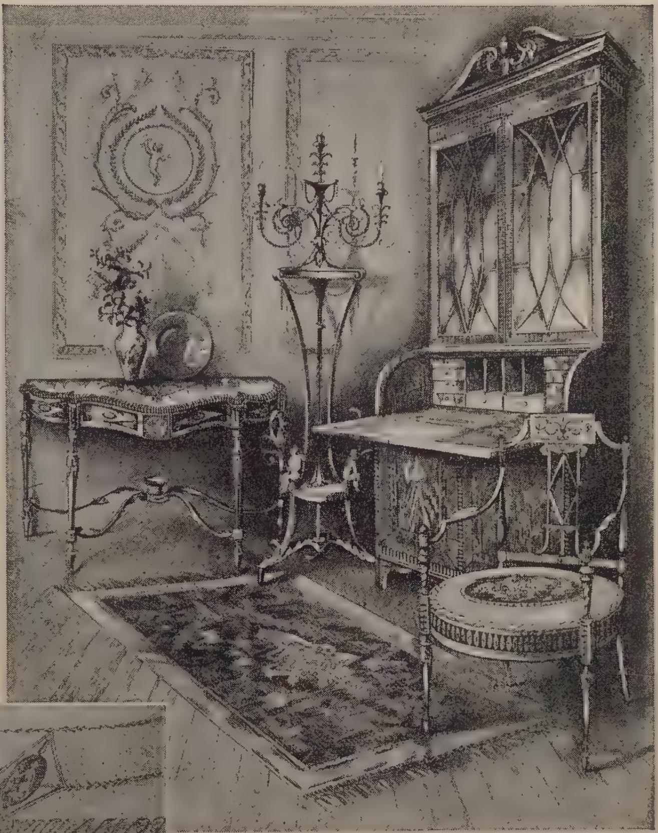
In the last generation, largely inspired by the work of the English artist, William Morris, there has been a growing demand for a revival of the old designs of simple and beautiful construction. The best work of the old masters has been copied and adapted, so that it is now possible to obtain furniture of beautiful design and finish at a moderate price.

The manufacturers of America are responsible for many unusual contrivances in furniture, including rocking chairs, combination chiffoniers, and folding beds and couches. The extension of the teaching of woodwork in schools is likely further to elevate the standard of taste and workmanship in furniture manufacture. In recent years chairs and other articles of furniture made of wickerwork and other forms of basketry have found much favor. These are woven by hand from "osiers" or willow shoots and various tall woody grasses known as "reeds." The so-called "fiber" furniture, which is woven from paper compressed into strands or twisted over wires, is said to have the merit of being more durable than either willow or reed.

The woods used in making furniture are varied, and change as often as do the designs. Early in the 19th century black walnut, maple, and mahogany were fashionable; then cherry and ash came into vogue. Oak was long forgotten, but toward the close of the century it took a prominent place, and is still popular for the hall, library, and dining room; while black walnut, once so fashionable, has passed almost entirely out of use. For bedrooms mahogany, curly birch, and maple are now much used, and for the dining and drawing rooms mahogany is still first choice in the better grades of furniture. Frequent changes have taken place also in furniture upholstery, an almost endless variety of textures, patterns, and qualities in coverings having superseded the slippery haircloth and other materials which were so popular a few decades ago.

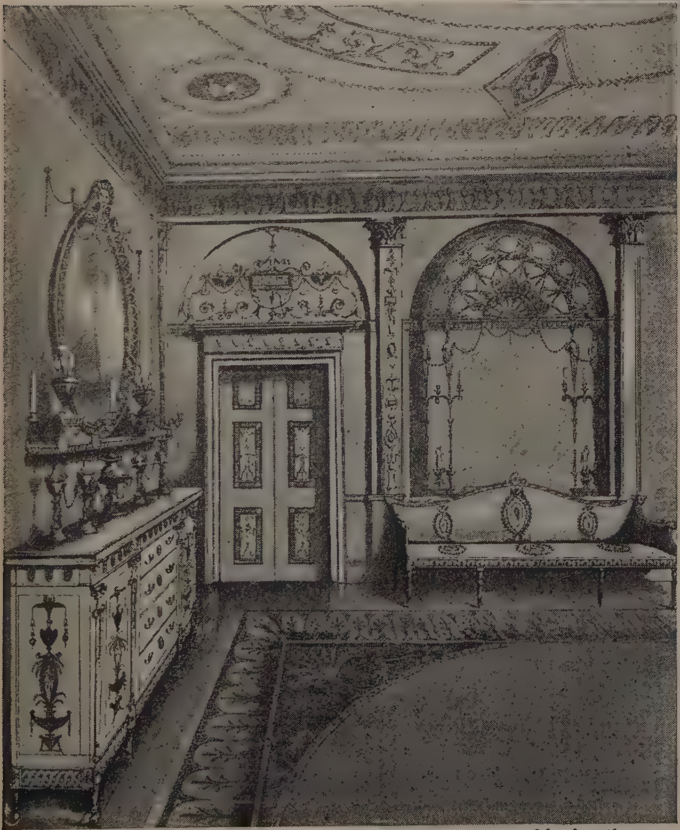
The great centers of the furniture-making industry in the United States are New York, Chicago, Grand Rapids (Mich.), Philadelphia, St. Louis, and Boston.

A CORNER IN A SHERATON ROOM



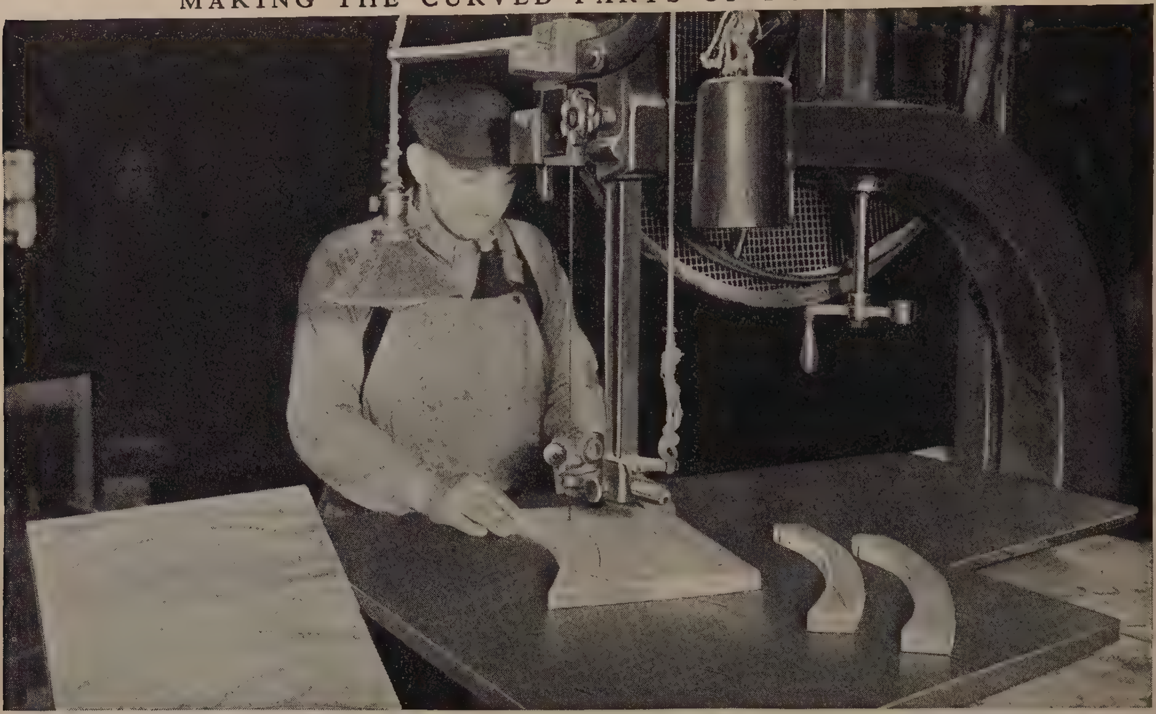
The chairs made by Sheraton, like those of Chippendale, are known for their grace and delicacy, although you see a Sheraton chair is very different from a Chippendale chair. His furniture was distinguished by slender forms and sweeping curves, and he made extensive use of inlaid woods, as shown in the charming little table against the wall.

AN ADAM ROOM

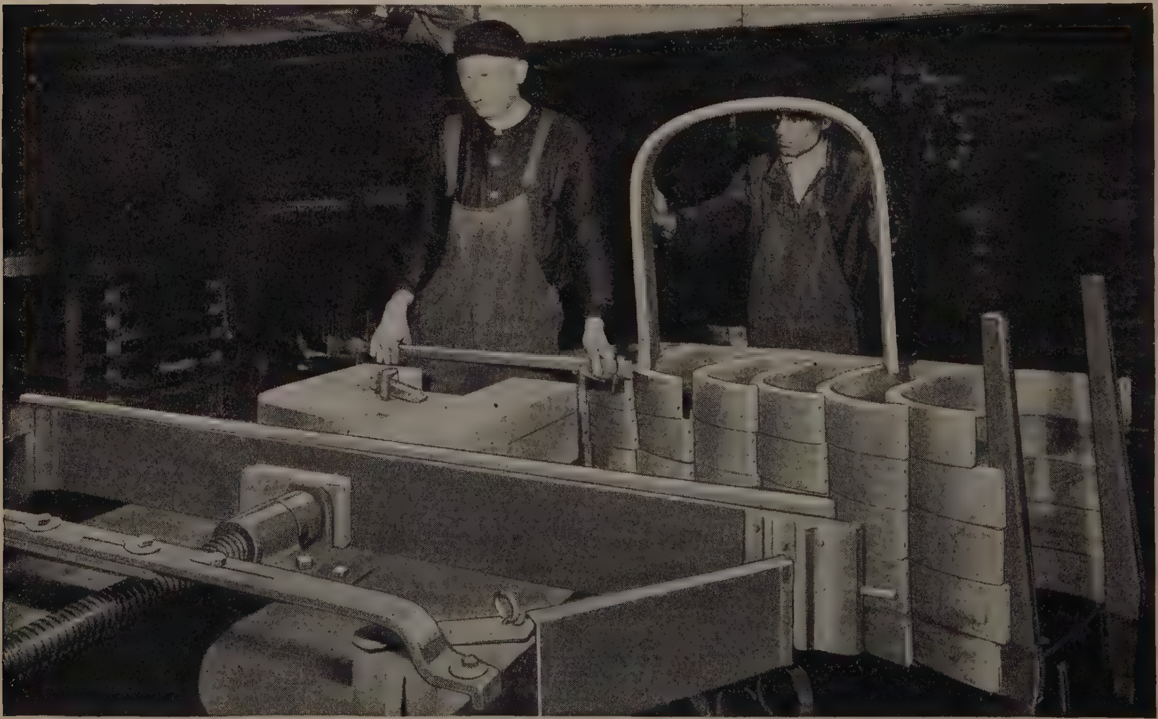


The Adam brothers of 18th century Scotland were notable for the care and skill with which they made their furniture harmonize with the design and decorations of the houses which they planned.

MAKING THE CURVED PARTS OF FURNITURE

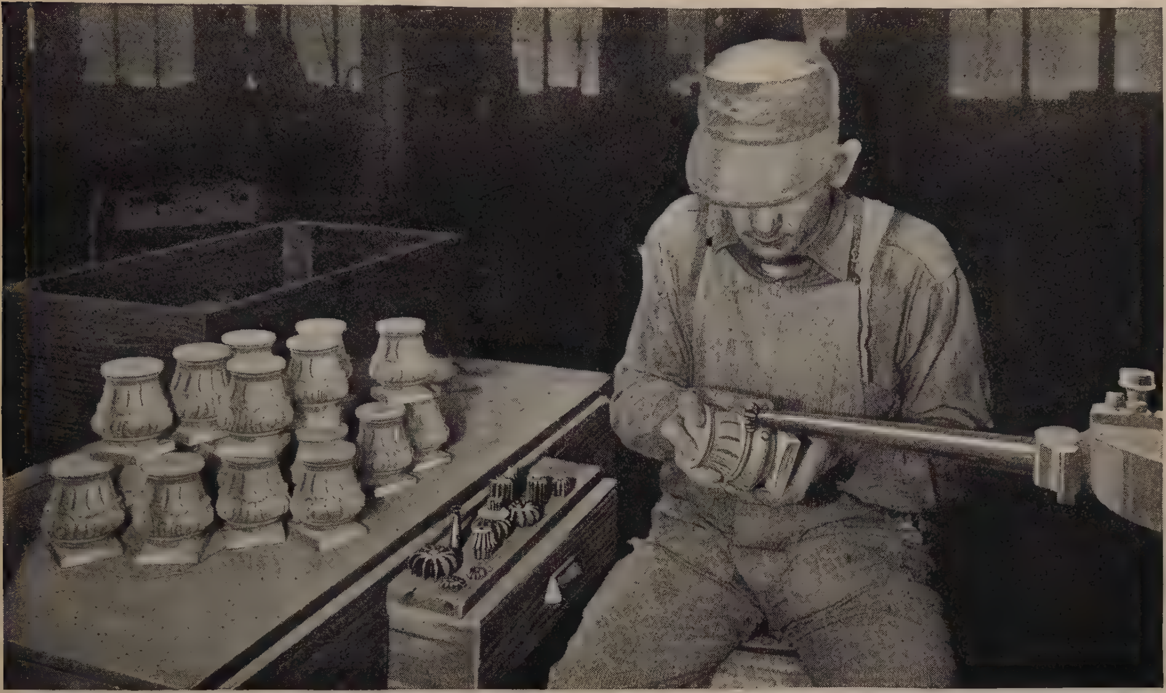


The illustration shows one of the methods of making curved parts for furniture. The pattern which has been marked on the wood is cut out with a band saw, operating at great speed through a hole in the steel table.

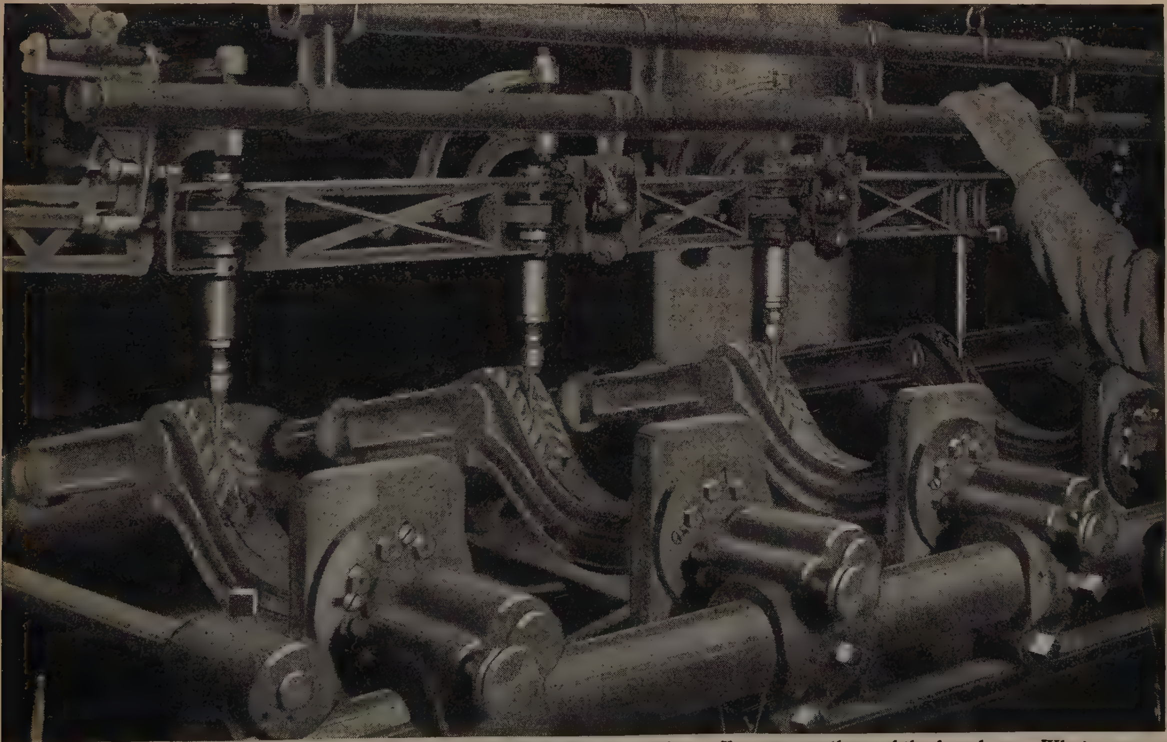


Here the curving is accomplished by the use of steam and pressure. The plank is first placed in a compartment filled with steam to give it pliability so that it will not break when put into the press. After being steamed, the plank is fastened in the pliable metal holder which you see here. The machinery then pushes both ends forward around that curved form, until the wood is bent to that shape. Then the man fastens both ends with the clamp he holds in his hands, and after it has remained for a time in this position, it holds its curved shape.

HOW WOOD CARVING IS DONE BY MACHINERY

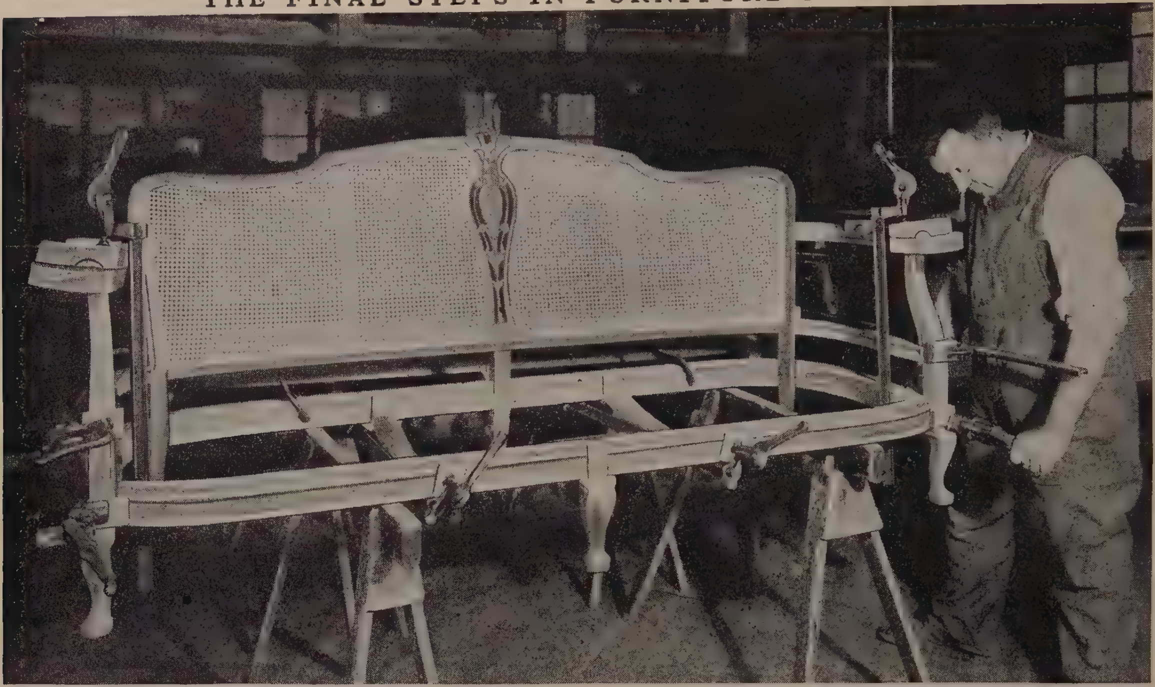


The man in the upper picture is a "spindle carver" and is making some ornamental pieces for legs and other parts of furniture. He takes a perfectly smooth piece of wood of the form required and by the use of those little rotary knives of various shapes, cuts it in intricate designs. The appropriate knife is attached, as you see, to the revolving arm and the workman has only to hold the wood at the proper angle.



This picture shows a machine that carves six legs exactly alike at the same time. You can see three of the legs here. What appears to be a fourth leg, at the right, is a steel pattern. The machine works on the principle of the pantograph. On the right, directly under the man's hand, is the guiding needle which goes over the pattern. The revolving knives repeat this pattern exactly on the wooden legs. Every furniture factory has many machines of this type.

THE FINAL STEPS IN FURNITURE MAKING



Once the parts of a piece of furniture have been cut out, shaped, and carved, they are brought together in the assembling room, where they are fitted together. If they match properly, they are fastened in place with pegs and screws and glue. Then heavy clamps are screwed on, as you see in the case of this sofa. These clamps hold the parts in position until the glue has "set," which usually takes from one to three days.

When the glue is dry, the furniture is taken to the paint shop. But no tedious work with the paint brush goes on there. The colors are sprayed on with a hose and nozzle, covering a chair like this one in a minute or so. The cage the man is working in is to prevent paint from scattering, while the fan drives out dust which might settle on the wet paint.

FURS. What visions the word "furs" calls up—of remote lands and waters, of savage warriors and lonely trappers, of Arctic travel and hardships, of lovely ladies and wealth beyond calculation! The skins of fur-bearing animals are bound up with the history of nearly all civilized peoples. Wherever winters were cold, one of the first concerns of primitive man was to provide himself with garments made from the warm thick coats of animals, for garments of skins and furs were worn long before he had learned to prepare wool. For furs he hunted and toiled, and when he had obtained more than he needed himself, he traded them to his fellows for food and weapons. Thus furs became an early medium of barter and exchange; and as the people of more temperate regions came to covet them for ornament as well as warmth, the fur-trade became one of the chief of primitive industries and remains of great importance to this day.

A HUNTER'S AND FUR TRAPPER'S CABIN IN NORTHERN CANADA

This scene is typical of the camps in the distant wilderness, where dwell the men who capture the world's supply of furs. Preparations are under way for the winter campaign, during which the camp will probably be cut off by snow from all communication with civilization. A bear skin is drying on the rack at the right.

To get the rarer and more beautiful skins, men have dared the dangers of the jungles of the tropics and the trackless wastes of Arctic snows. Tribes have fought with tribes and nations with nations for the sake of furs. In their insatiable demands for furs men have mercilessly hunted some of the most prized species, until such animals as the beaver, the fur-seal, and the sea-otter were threatened with extinction. In all ages the more costly furs have been the badge of wealth and dignity. In the Middle Ages the snowy white ermine with its black-tipped tails could be worn in England by none but members of the royal family, and ermine today is used in nearly all state robes of judges and members of the English court. Cat and rabbit fur in medieval times were the badge of the humble townsmen.

The colonization of North America is inseparably linked with the fur-trade, the Hudson's Bay Company being the chief agency. The fur-trader led the way across the Alleghenies in the American colonies and up the St. Lawrence in Canada. The first settlements were mere trading posts, to which the Indians brought the furs they had trapped and bartered them for guns and other articles. To name such outposts of the fur-trade as Vincennes, Detroit, Green Bay, Fort Snelling, Kaskaskia, Cahokia, Astoria, is to recall the early history of the great West. Other pioneers followed in the trail of the fur-trader, settled at or near the trading posts, and thus formed the nucleus of many of the great cities and thriving towns of today.

The United States is now the chief fur-consuming country, and the increasing demand for furs has caused prices to rise fourfold and more in the last generation. One of the results of this has been the rise of the industry of fur-farming, an outcome of the decrease of wild fur-bearing animals. The most notable example of this new industry is the breeding of the silver fox in Canada and some of the northern states of the Union. When the value of this new enterprise was realized, a furor of speculation inflated prices until a pair of silver foxes for breeding brought as much as $14,000. Other varieties of foxes, minks, raccoons, and skunks are now bred on farms that imitate as nearly as possible the natural homes of these animals.

Another result of the increasing demand has been the dyeing and counterfeiting of inferior skins to resemble the better varieties. The furs of the domestic cat and wild rabbit masquerade under a wide variety of names. White rabbit fur is prepared to imitate ermine and chinchilla. Clipped and dyed muskrat pelts are sold as "Hudson Bay seal," sable, and otter.

The otters furnish the most durable of all furs. Beaver, seal, raccoon, skunk, Persian lamb or astrakhan, and fox follow in order. The rabbit is the poorest of all, being reckoned as only one-twentieth as durable as otter. (*See also* separate articles under the names of the chief fur-bearing animals.)

PRINCIPAL FURS OF THE WORLD

NAME	SOURCE	USES
Astrakhan	New-born lambs from Astrakhan (Russia)	Muffs, collars, linings.
Badger	N. America, Europe, Asia	Carriage rugs, brushes.
Bear black	N. America	Muffs, capes, rugs.
Bear, brown	N. America, Asia, Europe	Muffs, boas or stoles, rugs.
Bear, grizzly	N. America, Russia, Siberia	Rugs.
Bear, white	Polar regions	Rugs.
Beaver	Throughout North Temperate Zone	Coats, muffs, trimmings, etc.
Cat, domestic	N. America, Russia, Holland, Asia	Linings and imitations.
Civet-cat	S. W. United States, Mexico	Linings, coats, trimmings.
Chinchilla	Peru, Bolivia, Chile	Coats, stoles, muffs, trimmings.
Ermine	Weasels in their white winter coat from N. America, Siberia	Stoles, muffs, linings, state and legal robes.
Fisher (see Pekan)		
Fitch	Polecat of Great Britain	Collars, muffs, trimmings.
Fox, blue (variety of white)	Polar regions	Stoles, muffs, trimmings.
Fox, cross, gray, red	N. America	Coats, stoles, muffs, trimmings, rugs.
Fox, Japan	China, Japan, Korea	Coats, stoles, muffs, rugs.
Fox, kit	N. America, Asia	
Fox, silver	N. America, Siberia	Coats, stoles, muffs, trimmings.
Goat	China, Russia	Coats, rugs.
Hamster	Germany, Austria, Russia	Linings.
Hare, polar	N. America, Siberia	Muffs, stoles, hats, imitations of lynx, fox, sable.
Karakul (Astrakhan of the best quality)	Lambs from Bokhara, Asia	Muffs, collars, linings, coats.
Kolinsky	Polecats or mink from Siberia, China, Japan	Muffs, linings, stoles, imitations of sable.
Lamb, Persian	Persia	Coats, collars, muffs, stoles, trimmings, gloves.
Leopard	China, Bengal, Persia, Africa	Coats, rugs.
Lynx	N. America, Europe, Asia	Trimmings, stoles, muffs, rugs.
Marmot	N. America, Asia	Imitations of mink and sable.
Marten	Europe, N. Asia	Muffs, collars, trimmings.
Marten, Hudson Bay	N. America	Imitations of sable.
Mink	N. America, Russia, China, Japan	Linings, stoles, muffs, coats, trimmings, caps, imitations of sable.
Mole	Europe, Asia	Coats, trimmings, stoles, muffs.
Muskrat	N. America	Linings, coats, robes, hats, imitations of seal, sable, otter.
Nutria	Northern S. America	Caps, hats, gloves, coats, trimmings, linings, imitations of seal.
Opossum, American	Southern United States	Trimmings, stoles, muffs.
Opossum, Australian	Australia	Rugs, robes, stoles, muffs.
Otter	N. America, Asia, Europe	Collars, cuffs, facings of men's coats.
Pekan or Fisher	N. America	Muffs, capes, trimmings.
Pony	Russia, Turkestan	Coats.
Rabbit (European coney)	N. Europe, Australia	Imitations of chinchilla, seal, skunk, etc.
Raccoon	N. America	Men's coats, stoles, muffs, robes.
Sable (a species of marten)	Siberia, China, Japan	Coats, linings, muffs, stoles, trimmings.
Seal	Bering Sea	Coats, trimmings, muffs, stoles, caps.
Sealine (Rabbit skin plucked and dyed black)	N. Europe, Australia	Trimmings, collars, etc.
Skunk	N. America, S. America	Collars, cuffs, muffs, trimmings.
Squirrel	Siberia, China	Linings, coats, capes, muffs, robes.
Wolf	N. America, Russia, Asia	Robes, muffs, and stoles.

GAL'AHAD. Of all the knights of the Round Table, according to the Arthurian legends, the noblest was Sir Galahad, whose faith and purity of life gave him powers denied to others. It was this spiritual strength that enabled Galahad to find the Holy Grail, the cup used by Christ at the Last Supper. This sacred vessel, according to the story, had been brought to Britain by Joseph of Arimathea, but when the land fell into wickedness it was hidden away; and the search for it became the noble quest of the knights of King Arthur's Round Table.

> *"My strength is as the strength of ten,*
> *Because my heart is pure."*
> —*Tennyson.*

One day, when the knights were talking of the Holy Grail, the torches in the great hall went out. Across the darkness streamed a band of silver light. Against that, faintly as through a mist, they saw a flush of rose. Only Sir Galahad saw the sacred cup clearly—"all crimson and glowing like a ruby," and heard a voice which said, "Galahad, follow me."

All the knights of Arthur's court swore a vow to live a holy life for a year and a day, while they searched for the lost Grail. Only four returned. Sir Bors and Sir Lancelot had seen the Grail in blessed visions. Sir Perceval had seen it because he was Galahad's friend, and next to him the purest in heart. After long wandering he had found Galahad in prayer in a hermit's cell, "clad in silver armor, and with a face like an angel's."

"Oh, my friend," said Galahad, "the Holy Grail shines always before me, blood red, and glowing like a star, guiding me to Heaven. It gives me victory over every sin and shame and wrong in the world. Come with me."

They went out into a storm, and over a hill top. Galahad ran before, across a bridge which spanned a black marsh, to the sea, and was seen no more. As Perceval knelt, weeping and praying, there came the beam of silver light, and on it the glowing Grail.

In the morning he found Galahad's body, beautiful, thin and worn as a saint's, and buried it by the sea.

"Because of pious zeal, repentance of sins, and goodness," said King Arthur, "three of you have had a vision of the Grail. But only Galahad really found the sacred cup."

The story of Sir Galahad is treated in Malory's 'Morte d'Arthur' and in other medieval romances. It is also the theme of Tennyson's 'Sir Galahad', and 'The Holy Grail' in his 'Idylls of the King'. (For other stories *see* Arthur; Round Table.)

GALILEO (*găl-ĭ-lē'ō*) (1564–1642). The first astronomer to use the telescope for examining heavenly bodies, the discoverer of the pendulum's laws, and the founder of modern physics, was Galileo Galilei (usually known as Galileo). He was born in Pisa, Italy, and died 78 years later, in the year of Newton's birth. With his telescopes, which were the wonder of that age, he discovered the mountains of the moon, four satellites of the planet Jupiter, and the peculiar appearance of Saturn which was later shown to be due to a great ring, or a series of rings, surrounding that planet.

When Galileo was a youth of 19 he saw a lamp in the cathedral at Pisa swinging regularly. He realized—what no one had realized before—that a pendulum swinging to and fro could be used to measure time, and so laid the foundation for the invention of the modern clock (*see* Pendulum). By dropping objects from the leaning tower of Pisa he also proved that falling bodies, however heavy or light, fall at the same rate (*see* Gravitation).

Galileo was a brilliant scholar with a quick and penetrating mind. He held the professorship of mathematics in the universities of Pisa and Padua; but in 1610 he left Padua for Florence, where he lived most of his remaining years.

Galileo made his first telescope with a piece of organ pipe, placing a lens at either end. It only magnified three times, but later he made a telescope that magnified 30 times (*see* illustration with Astronomy). With these he saw the mountains on the moon's surface, found that the milky way was a mass of very faint stars, and discovered the four largest satellites of the planet Jupiter. What he saw through his telescopes also convinced him of the truth of Copernicus' view that the earth rotates on its axis and revolves around the sun, and his ardent support of this view was the cause of difficulties with the church. In 1616 he was given a formal warning, but nevertheless he again provoked the indignation of the church authorities by publishing a dialogue on 'The Great Systems of the Universe', which offended by its misuse of Holy Scripture as well as by its biting satire.

For this publication he was summoned before the Inquisition, in October 1632. No one knows what happened during his examination, but we do know that he uttered a formal recantation of his views and was compelled by the tribunal to live in strict seclusion for the rest of his life. There is a story that as he rose from his knees he whispered defiantly, "Nevertheless it does move,"—referring of course, to the earth; but this is a fiction invented more than a century later.

Galileo achieved his greatest reputation as an astronomer, but it is probable that his chief service to science lay in establishing certain fundamental principles of dynamics, such as the law of falling bodies and the discovery that the path of projectiles is a parabola. He also constructed the first thermometer.

GALVANOM'ETER. An electric current creates a magnetic field around any wire it passes through. This behavior has been made to give us the delicate current-measuring instruments known as galvanometers, after Galvani, the famous Italian discoverer of "current" electricity.

The simplest type of galvanometer consists of a wire mounted at right angles above a compass needle. When a current passes through the wire, the needle is deflected and the amount and direction of the deflection indicates the strength and direction of the current. In more elaborate instruments the wire is wound into a horizontal coil, and the needle is mounted within it to swing in a vertical plane. When the current passes, the needle tends to turn upright, and a pointer attached to it sweeps over a scale to give the reading.

The most sensitive galvanometer is the D'Arsonval. An upright coil of wire is suspended between the arms of an upright horseshoe magnet. When a current passes through it, the coil turns against the resistance of its supporting wires, so that its axis runs more nearly from arm to arm of the magnet. A mirror on the face of the coil reflects a beam of light to a scale to give the reading.

Nearly all automobile dashboards bear galvanometers to show how the battery is working. These instruments are called "ammeters," because their readings are in amperes. Instruments adapted to measure volts are called "voltmeters" (*see* Electricity).

GAL'VESTON, TEX. In 1900 the city of Galveston—which is now one of the largest seaports in the United States and the greatest cotton-exporting port in the world—experienced one of the worst disasters in American history. On September 8 of that year a West Indian hurricane, blowing 120 miles an hour, struck the island on which the city stands, and in a few hours destroyed millions of dollars' worth of property. About 5,000 people were drowned in the huge waves swept in from the Gulf of Mexico.

But Galveston, like Holland, refused to yield to the ocean. The people immediately set about building a gigantic concrete sea-wall, 17 feet above low water, 16 feet thick at the base, and 5 miles long. Houses were lifted on stilts and street-car lines were elevated, while the whole city was raised to the height of this wall by pumping in nearly 20 million cubic yards of sand from the bed of the ocean. And lastly the city was joined to the mainland (a distance of two miles) by a giant causeway and bridge—one of the greatest structures in the history of engineering.

These improvements brought other advantages besides safety from the sea. Raising the level of the city made good drainage possible, and instead of being notorious for cholera and yellow fever, Galveston is now famous as a seaside and health resort, attracting more than a million visitors annually. The giant causeway, which is wide enough for three railroad tracks, besides an interurban electric line and a road for vehicles, has been an invaluable stimulus to business. The new "commission" form of government, which in the crisis was devised to supplant the old inefficient system, proved so satisfactory that it has been widely copied by cities in the United States and Canada (*see* Municipal Government).

Many millions of dollars have been spent by the United States government and by the city on harbor improvements. Granite jetties 12 miles long line the entrance, making it possible to maintain a channel 31 feet deep. Thirty enormous piers give berth room for more than a hundred ocean-going steamships at a time. The chief industrial establishments are cottonseed oil refineries, flour and feed mills, lumber mills, woodenware factories, cement works, shipyards, and ice factories. The island of Galveston, on the east end of which the city is built, is 30 miles long and 3 miles wide. Population, about 45,000.

GAMA (*gä'mä*), **VASCO DA** (1460?–1524). For more than 60 years the Portuguese had slowly but steadily been creeping farther and farther down the west coast of Africa in their efforts to find a new route to the Indies. The southern end of the continent had been reached in 1488, but for nearly 10 years nothing had been done, and in the meantime Portugal's neighbor, Spain, had entered the race for a route to the East by sending out Columbus. She had, it seemed, been successful in the contest when Vasco da Gama sailed from Lisbon in July 1497, in a final attempt to reach India by the route around Africa. He was selected for the command of the four small vessels—not unlike those of Columbus—because he was "a discreet man, of good understanding, and with great courage for any great deed." He was also "a gentleman of the king's household, and of noble lineage," and a skilled mariner. His voyage to India was a great feat of seamanship. The distance covered was three or four times as great as that to America, and the winds and currents he had to contend with were more difficult than those Columbus encountered. Like Columbus, he also had to contend with the timidity of his men.

After reaching Cape Verde on the west coast of Africa, Da Gama steered boldly for the Cape of Good Hope, called by his men the Cape of Storms. It required all of his resolution to keep his crews to their voyage after they had passed that point. Not if he were confronted with a hundred deaths, he said, would he go back a single yard, and he clapped the leaders of the mutiny into irons. On the east coast of Africa, Da Gama met Indian traders who gave him a pilot for the rest of the voyage. In May 1498, ten months after he sailed from Lisbon, he landed at Calicut, on the west coast of India. His reception by the ruler of the city was not at all friendly, and after seeing enough to convince himself of the immense wealth of the country, he returned home.

When the few survivors—55 out of about 170—arrived in Lisbon in September 1499, they were given a splendid reception. Vasco da Gama was granted the coveted title *Dom*, while his pensions and facilities for trade with the Indies made him one of the richest men in the kingdom.

In February 1502 Dom Vasco da Gama set sail a second time for India, and returned in September 1503, with the first tribute of gold from the East. In spite of the part he had played in gaining a foothold for Portugal in the East, it was not until 1524, when he was more than 60 years old, that he was appointed governor or viceroy of the country. Old as he was he set out energetically to reform abuses in the government, but within a few months after taking office he died.

His successful voyage to the East had brought to his country immense wealth and made her one of the foremost powers of Europe because she now controlled the route to the Indies. As Columbus opened the way to the West and its ultimate wealth, so Da Gama opened the way to the East and its immediate riches.

GANGES (*găn'jēz*) **RIVER.** Born in northern India in an ice-cave beneath the Himalayan snows, Ganges, the sacred river of the Hindus, breaks through the last mountain barrier just above ancient Hardwar. At first scarcely more than a series of broad shoals, long deep pools, and rapids, the river keeps to a southeasterly course through the land of the little talkative Jāts, busy in *gram* (chick-pea) and indigo fields, until Cawnpur is reached, that blackest spot on the Indian conscience. For here on a flight of steps, Massacre Ghat, leading down to the Ganges, 600 women and children were killed during the Indian Mutiny of 1857.

When one-half of its journey through the most densely populated region of the world is done, the Ganges is joined by a sister stream, the Jumna, their *doab* (land between two rivers) being irrigated by two very elaborate and costly canal systems fed from the Ganges. The little point of land thrust out into their united swirling waters is, next to Benares, the holy of holies for the Hindus; and here they come by hundreds of thousands each year, to wash away their sins in muddy "Mother Gunga," become deep enough now to bear all sorts of small native craft and navigable throughout the rest of her 1,540-mile journey to the sea.

In a great circle the river sweeps past Benares with every caste and creed of Hindu India swarming like a busy ant-hill down its drab stone *ghats* (steps) into the purifying flood of the Ganges, for the everlasting good of their souls and the cleansing of their bodies. At the head of its delta but still 240 miles from the Bay of Bengal, the Ganges, having dropped nearly to sea-level, slackens its pace, and begins to deposit along its banks the precious load of silt brought down from the Himalayas. When flood time comes this rich natural fertilizer is spread in a thin layer over thousands of acres. In such soil, with a thermometer rarely below 52 degrees and a rainfall varying from 37 to 65 inches, in addition to irrigation from a network of creeks, canals, and the countless fingers which the Ganges stretches across the triangular face of Bengal, vegetation grows as if by magic. Tea, turmeric, wheat and other grains are grown, pepper, quinine, and many costly spices and drugs, oil seeds, cotton jute, three crops of rice a year—everything which feeds and clothes a people and enables it to trade with foreign nations and makes of the Ganges "the river of cities."

Eighty miles from the sea, at Calcutta where smoke belches from factory and mill chimneys, the Ganges (called Hugli here) is choked with shipping. The narrow native canoes with a tiny deck-house and fat barges bearing bamboo cottages look strange enough beside great liners come from "home" and full-rigged sailing ships with low coal-barges tied alongside. An endless chain of black humanity scantily clad goes from barge to ship—bent nearly double under the weight of a heavily loaded coal basket.

The rest of the Ganges delta is a labyrinth of crocodile-infested waterways and ever-shifting river channels in which the native goes to market, calls on his neighbors, and even travels to his fields, with his patient water-buffalo, in a boat, not on a road. In the spring thousands of acres of growing rice are submerged up to the head of the grain, and the whole country looks like part and parcel of the sea. The volume of flood water that comes down then makes short work of embankments; whole cities have been wiped away in a night, and now no permanent structure is ever erected in this district. The barren waste which fringes off almost imperceptibly into the Indian Ocean, across the 165-mile breadth of the delta, is beloved only of the tiger and the one-horned rhinoceros that prowl through its swamps.

GAN'YMEDE. According to a Greek myth, this beautiful youth, the son of King Tros, attracted the notice of Zeus, king of the gods, who determined to make him his cup-bearer to succeed the goddess Hebe, and so sent his eagle to carry him off to heaven. Zeus gave Tros a pair of divine horses and comforted him by telling him that his son was now immortal. Ganymede was a favorite subject of ancient art.

The JOYS and PROFITS of the HOME GARDEN

WHEN you buy vegetables from the grocer, or flowers at the florist's, you do not get the best products of a garden. Magical gifts are produced there that cannot be bought at any price. But a garden of your own makes you rich in its opportunities to add to your health, your wealth, and your worth. It provides wholesome and profitable exercise for mind and body, tests your perseverance, and builds habits of industry and thrift. Every waste space, no matter how small, though filled with rubbish heaps or overgrown with weeds, is a challenge to the muscle of active boys and girls—yes, and to grown-ups too—to come into the out-of-doors and engage in a lively tussle, a real gardening contest for a prize beyond rubies in value.

GARDENS AND GARDENING. A well-kept garden brings a tingle of pride in ownership and of increased self-respect. Such a garden is a sign of good citizenship. There should be an honor flag over every garden in peace as well as in war, for the proper feeding of the people has become a national problem even in the United States, as it has long been in European countries.

Abraham Lincoln said, "Ere long the most valuable of all arts will be the art of deriving a comfortable subsistence from the smallest area of soil. No community where every member possesses the art can ever be the victim of oppression in any of its forms. Such community will be alike independent of crowned kings, money kings, and land kings." Food experts tell us that if every citizen of the United States were to make full use of his garden space, the annual products would take the place of at least 120,000 tons of sugar, 1,000,000 tons of flour, and 1,200,000 tons of meat. This includes the use of fresh vegetables and the surplus preserved, canned, or dried for winter use. On a plot of only 10 by 25 feet with an expenditure of less than $5 for seed and fertilizer boys and girls have supplied a family of four with vegetables throughout the season, representing a cash value of $30 to $60. If anyone should tell you that there was that much money buried under a rubbish heap, how eagerly you would devote your time to searching for the dollars!

The Miracle of Growth

Miracles are wrought in a garden if we have eyes to see them. The germ of plant life expanding under the friendly charm of sunshine and rain, air and soil, becomes a full-grown plant, bearing its gifts of beauty and usefulness. No investment on the stock market can rival nature's return, for she gives back a "hundred fold." You plant a tiny seed, and a few weeks later you harvest a basket of red ripe tomatoes, a big head of crisp tender lettuce, or a three-pound head of cabbage. From seeds no larger than a thumbnail, long vines spread over the ground, and when the flowers droop, tiny green balls develop into long green cucumbers, crooked-necked summer squashes, golden pumpkins, or tempting watermelons. A bushel of corn grows from a pocketful of kernels and you can bring to the garden a few handfuls of potato cuttings and cart away bushels of large fleshy tubers. If it is flowers you plant, the returns in beauty are beyond the measure of bushel baskets and dollar signs.

You may start your gardening in the fall with fertilizing and plowing or spading the land. Then plan your garden during the winter. If you intend to furnish your own home with fresh vegetables, you will want to plant small amounts of many different kinds, both early and late, so as to furnish a good variety all during the growing season; but if you intend to market your garden products it is usually the best plan to have only a few varieties so that you can get the best results. The vegetable chart at the end of this article may be helpful in making a selection. Seed-testing should also be done before time to plant in the spring.

Helping the Roots Along

The seed bed should be carefully prepared, for it is the storehouse of the necessary plant foods. After plowing or spading, the soil must be pulverized so that the roots can work freely through it in their search for nourishment. On small plots this can be done with hoe and rake. If the ground is low and level it may be well to divide the garden into small raised plots with ditches between so the water will drain off, for wet soil is cold and air is shut off from the root feeders. Some moisture is necessary, because the plant foods are dissolved in the water taken up by the plant. During hot dry weather the ground will dry out too rapidly if it is allowed to harden and crack on top. The moisture is conserved by keeping the top soil well worked (*see* Capillary Attraction).

Long before seeds can be planted in the outdoor garden, they can be sprouted indoors or in hotbeds and cold-frames. A hotbed is made by covering a few inches of fine loam over a deep layer of fermenting compost or manure. The fermenting process warms the soil. The cold-frame is a garden under glass which protects the early plants from frost. Plants may be started in a hotbed or cold-frame and then trans-

THE TRUTH ABOUT "CABBAGES AND KINGS"

Do you remember the "cabbages and kings" the Walrus talked about in 'Through the Looking Glass'? Perhaps it seemed like nonsense. But hear what Lincoln had to say on the subject of cabbages—serious garden cabbages like these—and kings. He said that the man who gets his living in this way from the soil becomes "alike independent of crowned kings, money kings, and land kings."

planted to the regular garden plot. Cabbages, tomatoes, celery, lettuce, and many other common vegetables may be started in this way to take full advantage of the growing season.

Transplanting should be carefully done or the growth of the plant will be disturbed. A place is made in the ground with the hand or a sharp stick to allow plenty of room for the roots of the young plant, and if some soil can be removed with the roots, so much the better. Transplanting is best done in the evening, otherwise the plants must be shaded from the hot sun. Water the plants after they are set out.

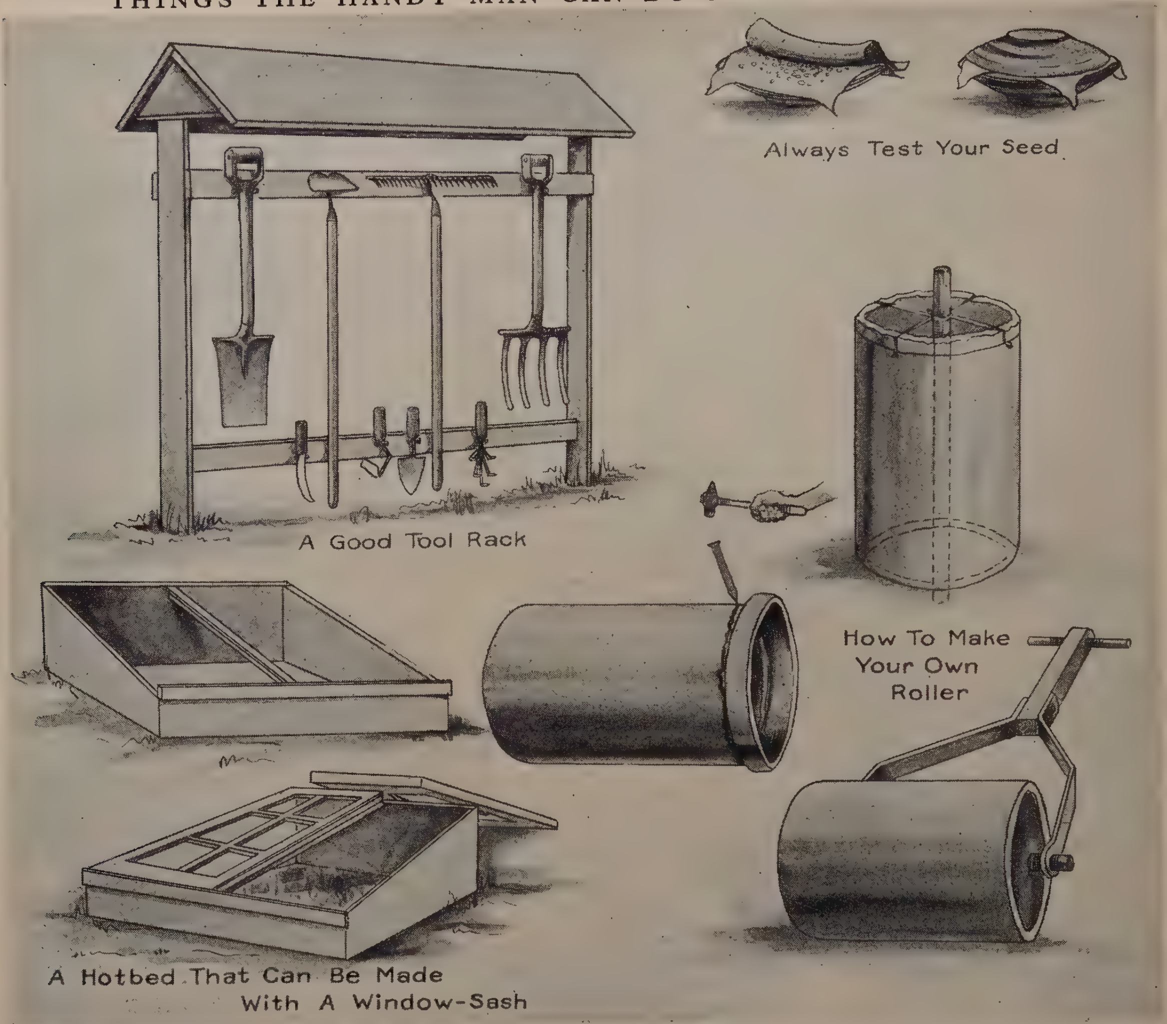
Defending the Plants from Their Enemies

Seeds are planted in the garden in straight rows or regularly spaced hills with markers at each row to show what has been planted there. Then comes the time of waiting and watching for the first green sprout. As soon as your garden is up, or even before, you must be on the watch for insect and fungus pests (*see* Spraying). Cultivating or hoeing is necessary to keep down the weeds between the rows, and weeds in the rows must be pulled by hand to keep them from taking the moisture and plant food. Thinning out the plant rows may be necessary to leave room for growth.

Vegetable growing on a large scale, called market gardening or truck gardening, is an important industry, especially near city markets. Vegetables grown in the South are shipped in refrigerator cars to Northern markets, and growing vegetables under glass all winter long has become a large industry. The great size of this industry is shown by the fact that in a single year, recently, 33 states marketed vegetables worth $125,000,000.

Home gardens are less profitable in money returns to the amateur gardener, but they yield large dividends in the way of pleasure. Who gets more joy out of life than the enthusiast about flowers, who is ever trying to make two petals grow where one grew before and develop a new variety remarkable for its delicate coloring, its graceful shape, or its superb proportions? No type of flower garden is more delightful than the old-fashioned garden, with its fragrant sweet alyssum and mignonette along the borders of the worn brick walks; its tall, sturdy cockscombs and sunflowers and hollyhocks looking over the fence; its clumps of defiant tiger lilies and pale peonies, its sweet-scented beds of phlox and petunias and clove pinks, its martial ranks of blue flags and its vivid rockets of scarlet

THINGS THE HANDY MAN CAN DO ABOUT THE GARDEN


Always Test Your Seed
A Good Tool Rack
How To Make Your Own Roller
A Hotbed That Can Be Made With A Window-Sash

The first thing to build for your garden is a good tool rack so that you can always find your implements when you want them. You can see from the picture how it should be built. The next thing will be a roller, to help break up lumps of dirt and smooth the ground. You can make this with a length of sewer pipe. You can cut off the flange with a hammer and cold chisel by nicking the pipe all around, and when the cut is deep enough, breaking off the flange with the hammer. Then the pipe should be set upright, and an iron pipe inserted through the middle, with wiring to hold it in place, so that it protrudes at both ends. When these preparations have been made, fill the inside of the pipe with concrete. When it has hardened, the roller is ready, and all you need to do is put a handle on it. The storm windows that come off the house in the spring can be used to cover hotbeds, as shown. The pictures show how to build a frame to hold them. This done, you are ready for planting. You can test seed before planting by placing a few samples between damp cloths, and keeping the cloths moist and warm within two bowls. If the sample seed sprouts within a few days, you can be sure that the seed is good.

sage—a delight from the time the first crocus opens in the grass until the last aster withers at the touch of frost.

Commercial floriculture embraces two main divisions, the cultivation of plants for indoor and outdoor use, and the growing of cut flowers. Roses, violets, carnations, and chrysanthemums, in the order named, are the most important cut flowers. In the neighborhood of the great cities particularly, the growing of cut flowers for the market has been so specialized that growers will devote themselves each to a single flower. On the Hudson River there are even whole communities largely devoted to violet growing. Such enterprises in the hands of experts are very profitable.

But the rewards of home gardening are much bigger than mere dollars and cents. As one enthusiast says, "Your chief joy in your garden will not be in the vegetables that you eat, nor in the flowers that you pick, but in the satisfaction of causing things to grow. You will enjoy the companionship of things that are real and clean. You will come to know the common and the little things. Just to have handled the new earth, and to have sown the seed, and to have thought about the garden at morning and at night—this is worth the effort. You have come nearer to nature. An interest in plants is part of our culture, akin to the interest in books and pictures and music." (*See also* School Gardens.)

WHAT AND WHEN TO PLANT IN THE VEGETABLE GARDEN *

The dates of planting shown in this table are approximate for the United States and will vary with the season. The dividing line between North and South is considered to be the continuation of the southern boundary of Pennsylvania or about the 40th parallel of latitude. Unless you have a large plot do not attempt to grow all the vegetables in this table. Usually the small home gardener will find it more advisable to buy plants of such vegetables as asparagus (preferably 1-year-old roots), cabbage, cauliflower, celery, eggplant, pepper, tomato, etc., than to grow them himself.

Kind of Vegetable	Seeds or Plants Required for 100 Feet of Row	Time of Planting out of Doors (N = North, S = South)	Distance between Plants	Depth of Planting	Time Required to Secure Crop after Planting
Asparagus	60 to 80 plants	Early spring	2 ft.	5 to 6 in.	1 to 3 yr.
Beans, bush (kidney and lima)	1 qt.	N— April to July S— Feb. to Apr. (Aug.)	2 to 4 in.	1 to 2 in.	40 to 65 da.
Beans, pole (kidney and lima)	4 oz.	May and June	18 to 24 in.	1 to 2 in.	50 to 80 da.
Beets	1 oz.	Early spring	4 to 6 in.	½ in.	60 to 75 da.
Brussels sprouts	¼ oz.	N— May to June S— Jan. to July	1½ to 2½ ft.	½ in.	100 to 125 da.
Cabbage, early	⅓ oz.	N—Mar.–April (start in hotbed Feb.) S— Oct. to Dec.	14 to 18 in.	½ in.	110 da. from plants
Cabbage, late	⅓ oz.	N— May and June S— June and July	18 to 24 in	½ in.	150 da. from plants
Carrots	1 oz.	Early spring, May 15 to June 15	3 to 6 in.	¼ to ½ in.	80 to 110 da.
Cauliflower	¼ oz.	May 15-June 15 (hotbed in March)	1½ ft.	½ in.	100 to 130 da.
Celery	½ oz.	May for early crop (start under glass in Mar. or April) July for late crop (sow seed in May)	4 to 8 in.	⅛ in.	160 to 170 da. from seed 90 to 100 da. from plants
Chard (Swiss)	2 oz.	Early spring to June 15	4 to 6 in.	½ in.	To middle of summer
Corn, sweet	2 to 3 oz.	Early spring	12 to 18 in.	½ to 1 in.	60 to 100 da.
Cucumber	½ oz.	N— May to June S— Mar. to April	4 to 5 ft.	½ to 2 in.	60 to 80 da.
Eggplant	¼ oz.	N— June S— Jan. to May	2 to 3 ft.	½ to 1 in.	120 to 150 da.
Kohlrabi	½ oz.	N— April to June S— Sept. to Mar.	6 to 8 in.	½ in.	75 to 120 da.
Lettuce	½ to 1 oz.	N— April to Aug. S— Oct. to Mar.	12 in.	$\frac{1}{16}$ to ½ in.	60 to 90 da.
Melon, muskmelon	½ oz.	N— May 15 to June 15 (sow seed under glass April 15) S— Feb.	4 ft.	1 to 2 in.	110 to 130 da.
Melon, watermelon	1 oz.	N— May 15 to June 15 S— Mar. to May	7 to 10 ft.	½ to 1 in.	115 da.
Okra, or gumbo	1½ to 2 oz.	N— May to June S— Feb. to April	14 to 36 in.	1 to 2 in.	115 da.
Onion, seed	½ oz.	N— April and May S— Oct. to Mar.	2 to 4 in.	¼ in.	135 da.
Onion, sets	1 to 1½ qt.	N— Early spring S— Fall and Feb.	2 to 4 in.	½ in.	60 da.
Parsley	¼ oz.	N— Last of Mar. to 1st of April S— Sept. to May	3 to 6 in.	½ in.	95 to 120 da.
Parsnips	½ oz.	April and May	3 to 4 in.	½ in.	125 to 160 da.
Peas	1 qt.	N— Early spring S— Dec. to April	10 to 15 in.	1 to 2 in.	60 to 80 da.
Pepper	¼ oz.	N— May and June (start early plants under glass in Mar.) S— Last of Mar.	18 to 24 in.	½ to 1 in.	100 to 140 da.
Potato, sweet	3 lb. (or 75 slips)	May and June (start in hotbed in April)	14 to 18 in.	3 in.	140 to 160 da.
Potato, white	5 to 8 lb. tubers	N— Mar. to June S— Jan. to April	12 to 18 in.	4 in.	80 to 140 da.
Pumpkin	1 oz.	N— May to June S— April and May	2 plants in hill 8 to 10 ft.	1 to 2 in.	110 to 140 da.
Radish	1 oz.	N— Mar. to Aug. S— Sept. to April	1 to 2 in.	¼ in.	30 to 40 da.
Rhubarb	25 to 50 roots	N— Early spring S— Fall	2 to 4 ft.	2 to 3 in.	1 to 3 yr.
Rutabaga	½ to 1 oz.	N— June to July S— Aug. to Sept.	8 in.	½ to ¾ in.	70 to 100 da.
Salsify	1 oz.	Early spring	3 in.	½ to 1 in.	130 to 160 da.
Spinach	1 oz.	N— April 1 to Sept. 15 S— Aug. to Oct.	6 to 8 in.	¼ in.	50 to 60 da.
Squash, bush or early	1 oz.	N— May S— Feb. to Mar.	3½ to 4 ft.	1 in.	60 to 75 da.
Squash, late	1 oz.	N— May S— Feb. to Mar.	6 to 10 ft.	1 in.	125 to 150 da.
Tomato	¼ oz.	N— May to June S— Jan.	2½ to 4 ft.	½ in.	130 to 150 da.
Turnip	½ to 1 oz.	Early spring	2½ to 8 in.	½ to ¾ in.	40 to 60 da.

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AMERICA'S SECOND MARTYRED PRESIDENT

JAMES A. GARFIELD

GARFIELD, JAMES ABRAM (1831–1881). When Garfield was assassinated on July 2, 1881, many comparisons were made between his life and that of Abraham Lincoln, the first "martyred president." Both were "self-made men." Both were born in log cabins, and endured in youth the privations which accompany farm life on the frontier—Lincoln in Illinois, Garfield in Ohio. As a young man, Lincoln took a flatboat down the Mississippi River; Garfield at about the same age served on a canal-boat on the Ohio and Pennsylvania Canal. Both were eager for an education; but while Lincoln attained his knowledge by studying at night alone, Garfield was able by hard work to obtain a college education.

Though Garfield was a tireless reader from his earliest days, reading over and over again every book he could borrow, his youthful ambitions were not along the lines in which he made his name famous. One of the books he read and reread, beside the flickering flame of the wood fire in the log cabin, was a book of sea stories. These so caught his youthful fancy that he resolved to become a sailor. At 17, with his mother's consent, he tramped across the country to Cleveland, and tried to ship on a lake-boat. The captain drove him from the deck, and the disappointed lad had to content himself as stated with a job on a canal-boat, driving the mules along the towpath and acting as deck hand. A lucky attack of sickness sent him home, and his ambitions were turned to higher fields. By the time he recovered, his mind had been set on becoming a teacher, and he started off to school with a slender capital borrowed from his widowed mother. After his first term he needed no more help from her, for he worked his way through the Eclectic Institute at Hiram, Ohio (now known as Hiram College), by farm labor and carpentering. When he was ready to enter college his choice fell on Williams College, because its president was the celebrated Mark Hopkins, for whom Garfield had the greatest admiration. Garfield used to say, "A log with a student at one end and Mark Hopkins at the other is my ideal college." He was graduated from Williams in 1856.

Garfield as a College President

When Garfield became, at the age of 26, president of the Ohio College where he had taken his preliminary work, he proved himself a teacher of the same type as Mark Hopkins—a man of unbounded zest for truth, limitless curiosity, and intense interest in his pupils. Had he remained in this work, he would doubtless have become one of the country's great educators. It is interesting to know that two of his sons also went to Williams College, and one of them, Harry A. Garfield, became its president. This son served during the World War of 1914–1918 in the important post of fuel controller. The second son, James R. Garfield, was secretary of the interior under President Roosevelt.

Garfield's rise was rapid. Within six years after his graduation he had been president of Hiram College, Ohio state senator, major-general in the United States army, and representative-elect to the United States Congress. A more rapid rise than this has been made by no American statesman, and the variety of the positions shows that he himself practiced his advice to young men, to "be fit for more than the one thing you are now doing."

Service in War and Public Life

While teaching at Hiram College, Garfield studied law; and from the time of his admittance to the bar, in 1859, until his death, he was continually engaged in politics, with the exception of the two years that he served in the field in the Civil War.

Though he was a brave soldier, and in 1863 was commissioned major-general for his bravery at the battle of Chickamauga, President Lincoln thought Garfield would be of greater use to his country in Congress. So he resigned his commission, in December 1863, and took the seat in the House of Representatives to which he had been elected the year before. There he made himself especially useful in the committees on military affairs and on finance. He served for 17 years in the House—until his election in 1880 to the Senate from Ohio; and it has been said that his speeches in Congress give a connected history of the times. Garfield was an impressive orator, because he had a powerful voice, great personal magnetism, and a straightforward style of address which aroused enthusiasm and carried conviction.

The triumph of his political career came when he unexpectedly received the Republican nomination for the presidency in 1880. The party was divided that year into two factions—the "stalwarts," who wished Grant to be nominated for a third term, and the "half-breeds," who opposed Grant and for the most part favored James G. Blaine. Neither side would yield, and after a long fight they compromised on James A. Garfield, a "dark horse." Because Garfield was a "half-breed," Chester A. Arthur, an uncompromising "stalwart," was made the candidate for the vice-presidency.

His Personal Appeal to the People

In the campaign which followed, Garfield spoke in his own behalf, the first time that a presidential candidate had thus appeared before the people. His was victoriously the overwhelming vote of 214 electorial votes to 155 given to General Hancock, the Democratic candidate.

Garfield never had a chance to show his ability as chief executive of the country. Four months after his inauguration he was shot by Charles Guiteau, a disappointed office-seeker. The tragedy was the result of the bitter quarrel between the "stalwarts" and "half-breeds" over appointments to office, a quarrel which absorbed all of the president's time before he was shot.

The day of the tragedy was to have been a red-letter day in the president's life. He was on his way back to his beloved college, Williams, from which he had been graduated 25 years before, to join in the reunion of his classmates. The assassin's bullet struck him down as he was walking through the railway station in Washington to his train. Garfield lingered between life and death for weeks and finally died Sept. 19, 1881. He was the 20th president of the United States, the second who was assassinated, and the fourth to die while in office.

GARIBAL'DI, GIUSEPPE (1807–1882). "The third time's the charm," according to the old saying, but it was the fourth attempt which brought Giuseppe Garibaldi, the knight errant of Italian unity, his signal success and enduring fame. Twice he joined in vain attempts to free Italy from Austrian rule, first in 1834 and again in 1848—and both times he was forced to flee from the country. In 1834 he escaped to South America with a sentence of death hanging over him. There he stayed for 14 years, taking part in the civil wars of Brazil and Uruguay, earning for himself the title of "Hero of Montevideo," and forming the "Italian Legion" which was later to help emancipate the homeland.

Returning to Italy he took part in the unsuccessful Revolution of 1848, and commanded the forces of the short-lived Roman Republic which he and Mazzini set up. When this collapsed, Garibaldi escaped in a wonderful retreat through central Italy, pursued by the troops of four countries. This time he sought refuge in New York, where he engaged for several years in trade and commerce and succeeded in accumulating a small fortune.

His third opportunity came in 1859, when Sardinia-Piedmont, with French aid, went to war with Austria. Garibaldi's Alpine infantry was victorious in the north, but further advance was checked by the peace made with the Austrians at Villafranca by the faint-hearted Napoleon III.

Secretly encouraged by Cavour, the great prime minister of Piedmont, Garibaldi and his "Thousand Red-Shirts" set forth in 1860 for Sicily, on one of the greatest filibustering expeditions in history and one that eventually gave to his king, Victor Emmanuel, the remaining half of Italy. Within a few short weeks after landing and assuming in the name of Victor Emmanuel the dictatorship of Sicily, Garibaldi had driven all the Neapolitan forces out of the island with little loss of life to his own men. He had come into possession of money, arms, boats, stores of all kinds, had increased his army to some 25,000 men, and had become the idol of all Sicily, to whom the red shirt of his warriors became the proudest badge of men and women. He had so completely aroused Italy that each town poured forth its young and old to join his victorious standard.

He Enters Naples in Triumph

When Garibaldi crossed from Sicily to the mainland, in August 1860, his march from Reggio to Naples resembled a triumphant procession. It was only necessary for Garibaldi to appear before a town for it to surrender. At one place, with a few hundred men back of him, he ordered 12,000 Neapolitan troops to surrender, and they immediately did so, for his cause was really their cause. He entered Naples in the midst of enthusiastic crowds, wildly cheering and singing the national anthem, from now on called the 'Garibaldi Hymn'. In accordance with the votes of the people, Garibaldi handed the kingdom of Sicily and Naples over to Victor Emmanuel, whom he acknowledged as the king of Italy.

Garibaldi himself, although he was the hero of Italy, was the most difficult problem that the new government of united Italy had to face. He never forgave Cavour for the cession of Nice—Garibaldi's birthplace—to France as the indispensable price of Napoleon III's aid to Italian unity. Only with difficulty was he restrained from his mad plan to attack Rome which was under the rule of the pope, although he knew that an attack on it would bring against the struggling kingdom of Italy the forces of both France and Austria—her friend and enemy. Twice the government was forced to send troops after Garibaldi and take him prisoner, in 1862 and 1867. When finally Italian troops entered Rome, in 1870, Garibaldi had no part in it, for he was at that time helping the new-born republic of France in its despairing struggle against Germany.

When the Franco-German war was over he retired again to his island home of Caprera, where he spent the rest of his life receiving admiring visitors and attempting to stir up the people to establish a republic in Italy. He was easily worked on by unscrupulous agitators who sought the overthrow of the united monarchy he had helped to establish. Fortunately the plots did not succeed, and Garibaldi today is regarded as the hero of Italian unity.

GARRISON IN THE OFFICE OF THE 'LIBERATOR'

How this picture carries us back to those troubled times before the Civil War, when young William Lloyd Garrison in his humble printing office was producing the little paper that proved such a tremendous force in driving slavery out of the United States! What a fine earnest face he has, and what a good head! While the two other men are putting the little paper to press, Garrison is "setting up" an article for the next issue. By working 16 hours a day they managed to publish their little four-page "sheet" nearly every week, in spite of the most violent opposition from slavery sympathizers.

GARRISON, William Lloyd (1805–1879). "I will be as harsh as truth and as stern as justice. I am in earnest—I will not equivocate—I will not excuse—I will not retreat a single inch—and I will be heard."

Imagine if you can the anger of the defenders of slavery, in January 1831, when the ardent young abolitionist, William Lloyd Garrison, hurled this challenge at them in the first issue of his paper, the *Liberator*, and further declared that he would not cease his agitation—

> . . . till Afric's chains
> Are burst and Freedom rules the rescued land.

And yet why should anyone fear this impetuous young reformer? He was poor, unschooled, and without influential friends; and he had recently been in jail for expressing his violent anti-slavery views.

Garrison had inherited from his mother a determined will and was used to battling with the world, for he had been forced to begin his struggle as a breadwinner when he was only nine years old. After trying shoemaking and cabinetmaking, he had found his lifework in the printing office of his native town of Newburyport, Mass. Here he gained the education that he had no chance to acquire at school.

At the age of sixteen he wrote an article and sent it to the editor unsigned. We can imagine his joy the next morning when the editor gave it to him to set up in type, thinking that it was from one of the leading politicians of the state. With this encouragement Garrison went on until he, too, became a newspaper editor. From the first he had been interested in the cause of the slaves, and he determined to devote his life to working for their freedom.

The anti-slavery cause was not a popular one in those days. Garrison could not get halls for his meetings; churches were closed to him; the state of Georgia offered a reward for his arrest and conviction; and his mail was filled with threats of death. In 1835 a mob dragged him through the streets of Puritan Boston with a rope about his body. But still Garrison kept on. Though the *Liberator* gained little financial support, Garrison and his partner were determined to keep the paper alive so long as they "could live on bread and water or find employment for their hands." By working 16 hours a day they managed to publish their little four-page paper nearly every week.

In 1832 Garrison organized the New England Anti-Slavery Society, the first of such societies in the United States; and the following year he went to England to consult anti-slavery leaders in that country, which was just on the point of passing a law, freeing the slaves in its colonies. On his return he took a leading part in founding the American Anti-Slavery Society, of which he later became president. A brilliant band of orators and writers was gradually attracted to this organization, the most distinguished of whom was the eloquent Wendell Phillips. From Phillips the society gained not only the advantage of his magic tongue, but also a flavor of respectability as the result of his social standing.

The nickname of "abolitionists" soon came to be applied to all those anti-slavery advocates, from the views of the extremists, who demanded the immediate abolition of slavery without regard to the United States Constitution and without compensation. From the laws of man sanctioning slavery they appealed to the "higher law" of God and nature. Garrison even went so far as publicly to burn the United States Constitution and denounce it as a "covenant with hell and an agreement with death." No man did more to end slavery in the United States than did Garrison; but it is also true that no man did more to make peaceful compromise impossible and war inevitable, except the no less extreme and fanatical supporters of the cause of slavery in the South.

But the triumph of Garrison came at last in 1863 when the *Liberator* printed Lincoln's Emancipation Proclamation, and two years later when he chronicled the passage of the 13th amendment to the Constitution, forbidding slavery in the United States. Feeling that its work was done, Garrison then discontinued his paper. As Lowell wrote—

In a small chamber, friendless and unseen,
  Toiled o'er his types one poor, unlearned young man;
The place was dark, unfurnitured and mean,
  Yet there the freedom of a race began.

Now that work was done and the freedom for the slave won. For a time Garrison's life seemed empty. But he was a born reformer and soon turned his attention to other fields. During the last years of his life he gave his support to the causes of woman suffrage, temperance, and peace.

A MAGIC CITY *and Its* FAMOUS SCHOOLS

The Great Steel Center that Sprang up in a Night, and the Development of the Gary Plan for Making Education "Interesting" to Boys and Girls

GARY, IND. In 1906 the site of Gary was a waste of sand-dunes and marshes. Today it is the world's greatest steel-producing center, with an area of more than 20 square miles, with scores of enormous industrial plants, and a population that ranks it first of the cities of northwestern Indiana.

The spectacular creation of this infant city was the act of the United States Steel Corporation, which chose this site for the erection of the huge plant of the Indiana Steel Company and other subsidiary enterprises, now employing tens of thousands of workmen. It owes its existence to its situation at the head of Lake Michigan, about 25 miles from Chicago midway between the iron ores of the north and the coal mines of the south, with the advantages of cheap water transportation both for its raw materials and its manufactured products. It was named for Elbert Henry Gary, head of the United States Steel Corporation. Population, about 55,000, of which about two-thirds are of foreign birth.

About Gary's Famous Schools

Important as it is industrially, Gary is almost as well known for its interesting school system. There is no other city in the United States, perhaps no other city in the world, whose schools were so much talked about, so much written about, and so much visited, within the years 1910–1920. During this period there was scarcely an American magazine of any sort which did not have one or more articles on the "Gary plan." Meanwhile, the Gary plan had attained so much popularity that in many cities "Garyizing" the schools had become an issue upon which school boards were elected and superintendents of schools appointed or dismissed.

There is probably nothing in the Gary plan which is not to be found in many other less-heralded school systems. Yet probably no one system has attempted to bring together so many features which thoughtful men and women have long been saying must be given a place in the modern school. Some of these are designed to bring children into contact with vital social interests and institutions, others to give them some direct preparation for earning a livelihood. Since an important feature of the Gary plan is housing in one building all grades from the kindergarten through the high school, it is impossible to carry out completely the idea of Supt. William A. Wirt, author of the Gary plan, except in the larger schools where all grades are to be found.

Here we find, instead of the old-fashioned style of schoolhouse made up chiefly of classrooms, a building in which about half the space is used for classrooms and the other half for kitchens, sewing-rooms, studios, laboratories, auditorium, gymnasium, and shops in which are taught such trades as carpentry, cobbling, forge and machine work, painting, pottery, printing, and sheet metal work. In many schools where such special rooms are provided, they are used almost exclusively by the high-school students; in Gary they are used by pupils of all grades.

Importance of Play in the Gary System

The Gary school plan affirms that it is even more important that children should have opportunities to play, in order that they may develop strong and healthy bodies and learn to get on with one another, than that they should learn the multiplication table or grammar. In few cities are the schools provided with such large playgrounds and such large athletic fields as the schools in Gary. Some of the Gary schools have playgrounds and athletic fields covering several acres.

The program of the Gary schools is so arranged that boys and girls who wish to work during school hours, or to take private lessons in some subject not taught in the school, such as music or religion, may do so. In order to give time for work, for play, and for outside lessons, the Gary schools have a seven-hour instead of a five-hour school day. This provides two hours each day which may be used for play, for work or outside lessons, and five hours for the ordinary studies and activities of the school.

The Gary plan places great importance upon regular daily auditorium exercises. The purpose of the auditorium exercises is to give the children social training, to teach them how to conduct themselves on such occasions in public, and to create wholesome and uplifting interests. Several grades often occupy the auditorium together. Sometimes the exercises consist of exhibitions of the work of a particular class or of music, travel talks, or motion pictures. The corridors are used for exhibitions of geographical and historical models, pictures, school work, etc.

Little Democracies within Four Walls

The discipline in the Gary school aims to prepare children to become citizens in a democracy. The discipline is therefore based upon the principles of democracy and freedom, and cultivates intelligence, liberty, and self-control. Pupils leave their seats when they wish without asking the teacher's permission. They move freely about the rooms and in the corridors. Responsibility is placed upon the pupils not only by this discipline, but by having them assist the teachers in the laboratories and in the shops.

The Gary schools aim to serve "all of the people all the time" as far as possible. Some of the ways in which this is done are: (1) by keeping the schools open all the year round; (2) by keeping the schools open on Saturday for children who are behind in their work or who are especially interested in any particular type of work; (3) by evening extension classes for adults; (4) by using the school as a social center for the entire community.

Superintendent Wirt claims that the Gary plan shows how it is possible to offer these unusual advantages without any greater expense than that of the ordinary school system. Expenses are reduced in several ways. The Gary plan practically eliminates supervisors who are specialists in the various subjects. It claims to decrease expenses by housing in one building all the grades from kindergarten through high school and making each school seat and desk serve two children instead of one. This is done by dividing each class into two sections or platoons. Platoon "A" occupies the seats and desks in the recitation room while Platoon "B" is sent to the laboratory, shop or playground, and vice versa.

Weaknesses of the Gary System

The first reports of the Gary plan published were uniform in their enthusiasm and praise. After a time a number of reports appeared which, though commending many things in the Gary plan, criticized much of the work in the schools. A report of the General Education Board praises the following things: (1) the large, generous, and modern conception of education upon which the Gary plan is based and the courage of the Gary school authorities in undertaking to put such a conception into effect; (2) the manner in which the schools are organized; (3) the democratic discipline; (4) the excellent spirit pervading the schools. It criticizes the work of the schools adversely as follows: "The execution of the plan is very defective with respect to administration and supervision of the teaching and pupils' work. The absence of proper accountability results in slip-shod work. Poor spelling, arithmetical inaccuracies, and grave omissions pass unchallenged." Another critic points out that adequate supervision would remedy the dirt and the indifference to proper light conditions and the resulting injury to pupils' eyes in many rooms. The dangers of attempting to make one seat serve two pupils are great. High school pupils sat with their knees hunched up toward their chins and their bodies twisted in small grade school seats. He comments also on numerous cases of disorder and inattention.

Probably the highest praise which the Gary schools deserve may be summed up by saying that they have shown how much more the schools of tomorrow must do and can do for the children than the schools of the past have done. It required no small amount of courage to experiment in establishing such thoroughly modern schools. The defects of the Gary schools are not due to faults in the ideas upon which they are based, but rather to the fact that in carrying out any new plan, those responsible for it and understanding it must be constantly on hand to supervise its execution according to clear and definite standards.

GAS. The most familiar example of what we mean by gas as a form of matter is the air, which is a mixture of oxygen, hydrogen, nitrogen, and other gases. Many gases are invisible, tasteless, and without smell, and can be detected only by their effects. The existence of air, for example, is readily observed when a current of it extinguishes a match, or when you feel it blowing against you. The gas which comes from the exhaust of an automobile may usually be seen, because it is slightly colored; but even if it had no color you could detect it by its unpleasant odor.

Gases have small densities as compared with liquids and solids, which is another way of saying that they are light in weight for the space they occupy. Water is 800 times denser than air, and air in turn is more than 14 times heavier than hydrogen.

Gases are indefinitely elastic; that is, they have no definite surface boundaries but tend to expand indefinitely and occupy any space within which they may be confined. The molecules of which they are composed are supposed to be much farther apart than those of liquids or solids. These molecules are in ceaseless rapid motion, bounding and rebounding from each other like rubber balls. When they strike the walls of the vessel which contains them, they produce a constant stream of tiny blows on all parts of it, thus exerting a pressure which we utilize to drive our automobiles and to send bullets and shells flying from guns. This explanation of the action of gases is called the *kinetic theory* of gases.

The pressure of a gas increases as the size of the container is reduced. For practical purposes, it may be said that reducing the volume one-half doubles the pressure, or to put it the other way around, "the volume of a gas varies inversely as the pressure." This is called Boyle's law, after Robert Boyle, an English scientist of the 17th century who first stated it.

If two gases be brought together they will gradually mix with each other, even though the mixing has to be done in opposition to gravity and through a thin membrane or piece of unglazed porcelain. Many gases dissolve in liquids. For example, ammonia and carbon dioxide readily dissolve in water. Air also dissolves in water to a certain extent, and thus fishes get the oxygen which they breathe.

The gaseous form of substances that are ordinarily liquid or solid, such as water, alcohol, and gasoline, is usually spoken of as vapor. Strictly speaking, however, there is no physical difference between such a gas as oxygen, for instance, and water vapor; for we know that all gases may be changed into the liquid form if they are put under sufficiently great pressure and the temperature is sufficiently lowered. Even air has been liquefied (*see* Liquid Air).

With the growing importance of gases in various commercial processes, and their increased military value as shown in the World War of 1914–18, this branch of chemical industry has become one of vital importance. Immense quantities of compressed gases are manufactured and shipped all over the country, often reduced to liquid form and held in exceedingly strong containers. (*See* Air; Atoms and Electrons; Gas, Illuminating; also articles on the important gases, Acetylene, etc.)

HARNESSING EXPLOSIONS

The Story of the Gas Engine

THE automobile hums over streets and highways, the swift motor boat sputters over lakes and rivers; the airplane roars its way through the clouds; the softly chugging submarine pierces the waves; and on the quiet farm sounds the whirr of machinery—pumping water, churning butter, lighting the house and barnyard at night with a blaze of electricity. All these are singing the great song of the gas engine—the engine that has transformed civilization and has made fairy tales and miracles come true in less than half a century.

GAS ENGINE. We cannot say that the automobile, the airplane, the dirigible balloon, and the submarine could not have existed at all without the gas engine. But it is certain that they would not have been developed so rapidly, so efficiently, and so economically. The steam engine requires a heavy boiler, a fire, and a large supply of fuel. The electric motor must get its electricity from a wire connected to a stationary plant or from a storage battery which is not only heavy but quickly exhausted. We may be sure that, with only steam and electricity, flying at least would not be a practical affair today.

The gas engine is compact, light, and capable of very high speed. It is economical, simple in construction, and easy to operate. In many parts of the West you will come upon reservoirs, for irrigation or for watering cattle, which are fed by gas engine pumps. A man visits them perhaps once a day to give them oil or gasoline, and the rest of the time they chug away in the wilderness until some worn part snaps under the long strain. And then almost any good blacksmith can mend them and set them to work again.

The uses to which the gas engine is put on the farm—where it has largely taken the place of the windmill—and in the shop are almost innumerable. In construction work it performs many of the tasks formerly assigned to the "donkey" steam engine, such as cement mixing, running elevators and derricks, etc. In many places where natural gas or other motor fuel is cheap, big gas engines are used to generate electricity for public use. In all parts of the world—in the burning deserts, on far-away coral islands, in the arctic regions, in tropical forests—you will find the gas engine helping to do man's work.

Although gasoline is the most commonly used fuel for such engines, any substance capable of forming an inflammable vapor or gas under ordinary conditions may serve the purpose. Illuminating gas, blast-furnace gas, kerosene, alcohol, crude petroleum, acetylene, and scores of other substances can be employed if suitable appliances are used. The principle in each case is, as we shall see, exactly the same, and depends upon the explosive or expansive powers of such gases or vapors when they are mixed with air and set on fire.

Because gas engines depend for their power upon the pressure created by the gases burning within the motor itself, and not upon boilers or other external generators of pressure, they are called "internal combustion" engines. Their early development was so gradual and so interwoven with other inventions that no one man is given the credit for being the actual discoverer of this type of power machine.

Steps in its Discovery

The first steps in this direction seem to have been taken late in the 17th century, when certain scientists experimented with "explosion" engines operated by gunpowder, without practical results. In 1791 an Englishman named John Barber took out a patent on a turbine run by illuminating gas. In 1794 Robert Street used the explosions of turpentine vapor to drive a piston, and many others followed. But it was not until 1860 that Etienne Lenoir, a Frenchman, invented a gas engine which came into commercial use. The credit for devising the gas engine as we know it today rests, however, with Dr. Nicholas A. Otto of Cologne, who worked out in 1878 the "four-stroke cycle" system found in most modern motors.

In its simplest form the gas engine consists of a cylinder open at one end, a piston with a long head to keep it straight inside the cylinder, a rod jointed to the piston and connecting it with a crank on the power shaft, and a heavy fly-wheel to help keep the shaft revolving once it has started. At the top of the cylinder, valves are arranged to let in the gas mixture at the proper time and to let out the burned gases after the explosion. Here also is the electric-spark device, which explodes the mixture inside the cylinder.

How a Four-Cycle Engine Works

Here is what happens when a one-cylinder Otto engine is running with illuminating gas: The piston is drawn down, opening the intake valve and sucking the gas into the cylinder. This is the first stroke. As the piston starts upward on the second stroke, the intake valve is closed, and the gas that has been sucked in is compressed into the top of the cylinder. As the piston reaches the top of its stroke the electric spark is set off, exploding the gas and forcing the piston violently downward on the third stroke. As it comes up on the fourth stroke, the exhaust valve opens, and the piston forces out the burned gas. The next stroke sucks in fresh gas again, and the whole process is repeated over and over.

As may be seen, there is only one explosion to every four strokes of the piston or every two revolutions of the crank shaft. The force of this explosion is taken up by the fly-wheel whose impetus keeps the engine moving until the next explosion. In two-cylinder engines the cylinders are timed so that one of them explodes at each revolution, giving a more continuous flow of power. If there are four cylinders, one of them explodes at each half revolution, and so on for six, eight and twelve cylinders. The cranks for the separate cylinders are, of course, arranged on the shaft to conform with the time of the explosions.

Geared to the main shaft of the engine are other shafts, usually two in number, which operate the opening and closing of the intake and exhaust valves. This is accomplished by means of "cams" or metal projections from these shafts. As the shafts revolve, the cams strike the valve rods, raise them, hold them open the required length of time, then drop them again. Strong springs help to hold the valves tightly closed.

The cam which times the electric spark in each cylinder is also situated on one of the cam shafts. This spark is generated by an electric circuit called the ignition system, operated by a set of batteries or a magneto. One wire of the circuit is "grounded" on the metal of the engine, the other leads to a spark plug screwed in the top of the cylinder. This spark plug, usually made with a porcelain core and a metal jacket, terminates in two metal points, about one-thirty-second of an inch apart, inside the cylinder. One of the points comes down through the insulated center of the plug; the other projects from the metal jacket and thus brings the "grounded" current from the metal of the engine to the sparking point. At the proper moment the spark leaps the gap and ignites the gas mixture compressed in the cylinder.

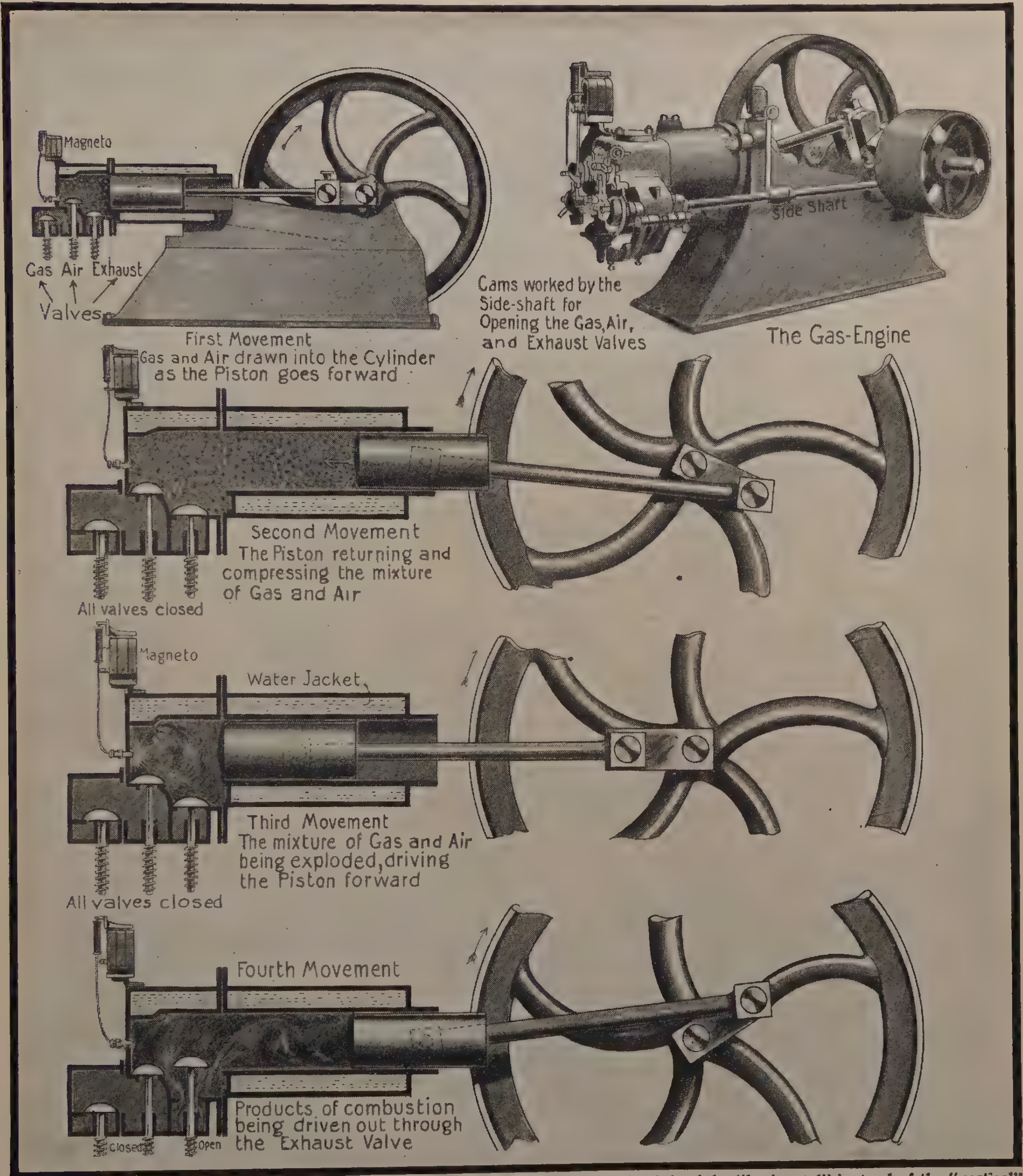
The crank shaft, the cam shafts, etc., are usually inclosed in a covering called the crank case. The bottom of the crank case is filled with oil, and as the piston rod splashes into this oil at every revolution, the interior of the engine is lubricated.

The Lungs of the Engine

So far, we have seen all the essential parts of an engine designed to run on ready-made gas. But when gasoline or any other liquid fuel is used, the Otto type of engine has to have an attachment for turning this liquid into a gas or vapor and mixing it with air so it will explode. This attachment is known as the carbureter, and may be called the "lungs" of the gas engine. Acting under the suction of the piston, air is drawn at tremendous speed through a narrow passageway in the carbureter. In this passageway is a needle valve, which is kept filled with gasoline by a float device. As the air rushes past the valve, it draws out the fuel in the form of a fine spray or vapor, which mixes with the air and is thus carried into the cylinder.

The exhaust of a gas engine is usually carried off through a large pipe terminating in a muffler, which deadens the sharp sound made by the escaping gases.

LOOKING INSIDE A GAS ENGINE


Magneto
Gas Air Exhaust
Valves
Cams worked by the Side-shaft for Opening the Gas, Air, and Exhaust Valves
Side Shaft
The Gas-Engine
First Movement
Gas and Air drawn into the Cylinder as the Piston goes forward
Second Movement
The Piston returning and compressing the mixture of Gas and Air
All valves closed
Magneto
Water Jacket
Third Movement
The mixture of Gas and Air being exploded, driving the Piston forward
All valves closed
Fourth Movement
Products of combustion being driven out through the Exhaust Valve
Closed
Open

Here you see a "four-cycle" Otto engine of the kind described in the text, except that it is of the "horizontal" instead of the "vertical" type—the cylinder lying on its side, so to speak. Notice how there is only one explosion for four strokes of the piston. At the top, the piston is commencing to move out under the impulse of the whirling fly-wheel, sucking in a fresh supply of fuel; on the second movement, it is coming back to compress the gas mixture; the third movement is caused by the explosion, which forces out the piston and gives the fly-wheel a new impulse; and, finally, at the bottom you see the piston about to return and force out the burned gases. In the first movement, the air and gas valves are open; in the next two, all valves are closed; and in the last, the exhaust valve alone is open.

The enormous amount of heat generated by the explosions inside the cylinder makes some cooling device necessary to prevent damage to the metal. Some small motors are air-cooled, having exterior flanges to provide as large a radiating surface as possible. But the great majority of gas engines are water-cooled, and for this purpose a metal jacket surrounds the cylinder proper, leaving an open space through which water circulates constantly. In stationary engines a steady stream of fresh water may be used, but in motor vehicles the water is usually pumped through a radiator, which consists of a large number of small tubes, exposing as much cooling surface as possible to the air.

Two-Cycle Engines

The so-called "two-cycle" engine, often used in motor boats and elsewhere, differs from the "four-cycle" in that it has an explosion for every two strokes of the piston, in other words, for every single revolution of the crank shaft. This is accomplished by a system of ports or openings near the base of the cylinder, which are uncovered as the piston reaches the bottom of its stroke. In the brief instant before the piston starts up again, the exhausted gases rush out through one of the ports and the fresh gas mixture, which has been compressed in the air-tight crank case, rushes in through the other. Then the upward stroke not only compresses the fresh mixture, but draws a new supply into the crank case. Then the explosion at the top of the stroke starts a new "cycle."

The Diesel engines, which became famous during the World War of 1914–18 because of their use on German submarines, differ somewhat in principle from the Otto engines. The heat created by the tremendous compression of air in their cylinders enables them to dispense with carbureters and ignition systems. Any fuel oil, even heavy petroleum or tar oil, can be used in these engines, because it is vaporized by the high temperature as soon as it is injected into the cylinders. Diesel engines are sometimes called combustion engines to distinguish them from the explosion type.

An almost endless variety of models of gasoline engines have been developed to meet various requirements, from the steady, heavy stationary type to the light, swift, powerful airplane motors. Famous among these is the Liberty Motor, designed for the United States air service during the World War, which developed enormous power for its weight (*see* Airplane). The gyro or revolving motor of the Gnôme type is perhaps the strangest gas engine ever built. Its crank shaft is fixed and its cylinders, arranged like the spokes of a wheel, drive themselves around the crank shaft, the power shaft being attached to the rapidly whirling cylinders. (*See* Airplane; Automobile; Submarine.)

The INVISIBLE FUEL *that* COOKS *Our Meals*

How William Murdock Took a Tea Kettle Full of Coal, a Thimble, and a Little Iron Pipe, and Gave the World a New Source of Light and Heat

GAS, ILLUMINATING. A Scotch engineer named William Murdock about 1792 began the experiments which resulted in the application of coal gas to lighting purposes. He heated coal in a kettle and by means of an iron tube carried the resulting yellow gas to a tank. When he had collected enough gas he fitted over the end of the tube a silver thimble, in which he had bored a small hole. Lighting the gas that escaped through the hole in the thimble, he found he had a good light to read by. He had a gas storage tank, a gas pipe, and a gas jet—a complete gas plant on a small scale.

You can make gas just as William Murdock did. Fill a clay pipe with coal dust. Cover the top with modeling clay or stiff mud. Then set the bowl of the pipe over a flame to get very hot. In a few minutes a yellowish smoke will come through the stem. Touch a match to it, and it will burn, but not very clearly, for it is full of impurities. In gas plants these impurities are taken out to make a colorless, smokeless gas and a clear flame.

By 1802 Murdock had succeeded in producing gas in sufficiently large quantities for lighting a foundry, and five years later his discovery was applied to the lighting of streets in London. American scientists who heard of Murdock's achievement followed his example. Gas was used on a small scale for street lighting in Newport, R.I., in 1806, and in 1817 Baltimore installed a complete system of street lighting. Today coal gas is used to light our houses and streets, to cook our meals, and to furnish fuel and power for industries.

What a Big Gas Works is Like

In the manufacture of gas great ovens of brick, called retorts, are filled with from 250 to 350 pounds of coal; a large gas works may have a hundred furnaces or more, each heating from five to ten of these retorts. The retorts are tightly closed, and the coal is roasted, producing coke (*see* Coke) and gas. This coal gas is a mixture of various substances, chiefly hydrogen, carbon monoxide, marsh gas (methane), and other hydrocarbons which burn readily. Nitrogen and carbon dioxide, which are incombustible, are also present, and the gas contains many impurities, such as ammonia, tar, sulphur compounds, and water vapor. To rid it of these, the gas is passed through water, where it loses some of its tar and ammonia; it is then condensed, and passed through the "scrubber" to remove more tar and ammonia. Formerly the tar was not used, but today it is a valuable by-product (*see* Coal-Tar Products). Finally the gas passes through layers of lime or oxide of iron to remove the sulphur, after which it goes into huge storage tanks until it is used. These tanks are great iron cylinders, closed at the top and open at the bottom, resting in cisterns of water. They rise and fall according to the volume of the gas, thus keeping a constant pressure which forces the gas out through the mains.

The old-fashioned flat tip burner was for many years the only method of using gas for lighting. Two discoveries revolutionized lighting methods and enabled the production of a much better light with the use of less gas. One of these was the invention of the Bunsen burner, which mixes the gas with the air and thus produces complete combustion and much greater heat, with an almost colorless flame. The other was the invention of the incandescent mantle, in 1886, by Dr. Carl Auer von Welsbach of Vienna. In the Welsbach system the light comes from a "mantle" heated white-hot in the Bunsen burner. The materials for these mantles come from opposite sides of the earth. Natives of India grow the China grass, whose fiber is needed for weaving the mantles, while in far-away Brazil rare earths are mined containing the chemical elements thorium and cerium, with which the mantles are saturated. After the vegetable fiber of the China grass has been burned away, a mineral "skeleton" of the fabric is left, which glows with a bright white light. The illuminating power of gas is increased about three times by the use of the Welsbach mantle.

THE FIRST HOUSE LIGHTED BY GAS

Imagine the astonishment of passers-by when they saw the windows of William Murdock's house in Redruth, England, gleaming for the first time with a brilliance that no candles or lamps could hope to attain! He made the gas at home and the next year (1802) illuminated a foundry with the new fuel.

But, with the advent of electric lighting, the use of gas for illumination has become less important than its use as fuel. The gas-range has largely replaced the coal-range in the homes of city dwellers, its chief advantages being the ease with which the heat can be turned on and off, and its general cleanliness.

Gas is distributed from the manufacturing plant through "main" pipes, sometimes as much as six feet in diameter. From these, service pipes lead to the individual consumers, where meters measure the amount used (*see* Meters). The pressure in the service pipes varies in different places from about one to two ounces per square inch. In places where the population is scattered over wide areas, the use of high pressure gas (from 10 to 20 pounds per square inch) has been largely advocated in recent years.

Many cities now use a gas called "water gas," a mixture containing chiefly hydrogen and carbon monoxide, made by passing steam through red-hot coke or hard coal. The gas thus produced burns with a very hot blue flame, but it is extremely poisonous because of the high percentage of carbon monoxide it contains. To fit it for use as an illuminating gas it is "carburetted," that is, mixed with gases which burn with a luminous flame, such as ethylene and acetylene. Another gas, highly useful in industrial processes, is "producer" gas. The best quality is made by passing air through white-hot coke, although coal and even peat may be used. Blast-furnace gas, generated in the operation of blast furnaces, is another fuel of this type.

Most of the railroad cars of the United States are lighted by compressed gas made from petroleum, in what is called the *Pintsch system*. Acetylene gas is widely used where there are no central gas works (*see* Acetylene). Gasoline is also used for illumination, by vaporizing it in a current of air in an incandescent mantle.

Gas, Natural. For a long time natural gas was regarded merely as a curiosity. In China, Persia, and British India, where it issued from crevices in rocks, it was kept burning and worshiped by the natives as a fire god. Near Baku, on the Caspian Sea—one of the world's greatest oil centers—are the ruins of an old temple built on the site of one of these fiery jets.

The United States apparently has the greatest wealth of natural gas. "Burning springs" were known in this country as early as 1775, and its first discovery by drilling was made early in the 19th century. Workmen boring a salt well in Ohio struck a subterranean gas pocket, and when it flamed forth they fled from the spot crying, "We have drilled through to hell!"

In 1821 natural gas was used for lighting in Fredonia, N.Y., but it was not until 1872 that it began to be collected and piped on a commercial scale. The beginning was made in Titusville, Pa., in the heart of the Pennsylvania oil regions, and since that time the natural gas industry has had a tremendous growth. The total amount used each year is now valued at about $120,000,000—a sum four times greater than the annual gold production in the United States. Natural gas has been a boon to many specialized industries, particularly in fine smelting and in the manufacture of gears, where a hot clean flame is needed. It is the cheapest fuel known.

In view of its present value, we now realize that fortunes were wasted in the early days, when the gas, shooting up in great flaming geysers, was allowed to burn on unheeded. Natural gas is almost always found in the neighborhood of oil wells, and in one oilfield in Oklahoma 3,000,000 cubic feet of gas worth $75,000 escaped every day for a year, while only $25,000 worth of oil was being collected. This early waste has resulted in exhausting many of the gas wells, and many cities which for a time used this natural fuel for heat and light have seen their supplies dwindle to nothing.

Wastage has virtually stopped today, and many thrilling stories are told of how "roarers" 100 feet high have been smothered, confined, and tamed to use. There are now nearly 3,000,000 consumers of natural gas in the United States, and the number is gradually increasing, as fresh fields are discovered.

The chief producing states are West Virginia, Pennsylvania, Oklahoma, Ohio, Louisiana, Kansas, California, Texas, and New York. In Canada the principal fields are in Ontario and Alberta. Natural gas has also been found in Australia, Rumania, Russia, India, China, and Japan.

Natural gas occurs pocketed in rock formations of various ages. It is not a chemical compound, but a mixture of several compounds—combustible gases and vapors, chiefly methane. It is generally believed that it is produced by the decay of organic matter—especially vegetation deposited in by-gone geological ages. The reservoir containing the gas is a porous rock, such as a coarse-grained sandstone or limestone; it usually has as a cover a heavy shale, which keeps out water and air and keeps the gas in.

The wells vary in depth from 250 feet to more than 7,000 feet and in diameter from 2 to 8 inches. The open flow varies from 500 to 35,000,000 cubic feet a day. A volume of 1,000,000 cubic feet per day is considered a profitable commercial well.

GAS WARFARE. The employment of poisonous and asphyxiating gases became one of the most terrible of modern methods of warfare after the Germans had introduced it at Ypres in 1915, in direct violation of a regulation of the Hague Convention (*see* Hague Peace Conferences). The gases used include the familiar iritating chlorine; diphenylchloro-arsine, a "sneeze gas" or sternutator; superpalite, a tear-compelling gas or lacrimator; phosgene, a gas so deadly that one part in 10,000 of air may be fatal; and many others acting in various ways, some attacking the lungs and causing asphyxiation, some paralyzing the nerves, some producing nausea and vomiting and thus compelling the soldier to remove his mask and expose himself to deadlier gases, and others—the deadliest of all—attacking, consuming, and burning all exposed tissues. To the last class belong the so-called "mustard gas" (dichlor-diethyl-sulphide), and ethyl dichloro-arsine, both of which are not gases at ordinary temperatures, but volatile liquids spreading corrosive fumes which linger in soil and clothing for days. Soldiers who had worn gas masks continuously were overpowered on removing their masks 12 hours after a mustard gas attack.

These poison gases were diffused by two chief methods, the gas cloud and the gas shell attack. For the former, chlorine and phosgene, which is composed of chlorine and carbon monoxide, were chiefly used. These gases, liquefied under heavy pressure and placed in large metal cylinders, were liberated when the wind blew toward the enemy. This method has the disadvantage that, if the wind changes, the gas cloud may be rolled back on the attackers. Gas shells are like ordinary explosive shells, except that they are almost filled with liquefied gas, and contain just enough explosive to burst the shell.

For protection against gas attacks, all soldiers in front line trenches were equipped with gas masks. These were of two chief types, either a bag worn over the head or a box slung on the chest, with nose-piece and breathing tube attached. They contained either neutralizing chemicals or charcoal, which because of its ability to absorb many times its own volume of gas was most generally used. Because charcoal made from nutshells and fruit pits was found to be the best for the purpose, large quantities of these were collected by boys and girls all over the United States.

GASOLINE. A colorless inflammable liquid produced by distilling crude petroleum. In Europe the accepted name for it is petrol. Until the discovery of the immense power that can be developed from gasoline, it was considered a waste product in the refining of petroleum to obtain kerosene. It has now become of great commercial importance as the most convenient source of vapor for internal combustion engines of the types used in automobiles, airplanes, tractors, certain stationary engines, etc. Gasoline is more volatile than kerosene. (*See* Petroleum.)

GATES, HORATIO (1728–1806). To General Horatio Gates belongs the honor of having commanded the victorious American troops in one of the world's decisive battles, the battle of Saratoga in the Revolutionary War, and yet before the close of the war he had retired from the army in disgrace. This fall from the position of a successful commander and a popular idol to that of a military failure and a despised intriguer is explained in a large degree by Gates' exaggerated ambition, a trait which had manifested itself in his early career.

As a young British officer he had served with General Braddock at the time of that officer's disastrous defeat by the French in 1755 (*see* French and Indian War). Impressed by the visions of prosperity he had seen and by the easy successes to be won in the New World, he had settled in Virginia at the close of the French and Indian War in 1763.

At the outbreak of the War for Independence he was made an adjutant-general of the Colonial army by the American Congress, and the next year was put in command of the army which was retreating from Canada. As commander of the army in the North, Gates received the surrender of Burgoyne at Saratoga on Oct. 17, 1777, and for a time was hailed as a great general. Many people have thought that he did little to gain the decisive victory, and that most of the credit belongs to General Schuyler whom Gates superseded. Soon he became the center of a plot, known as the "Conway Cabal," to take the supreme command from Washington and give it to him. The plot failed. In 1780 Gates was placed in command in the South, but at the battle of Camden, S. C., his troops were completely defeated by Cornwallis. When nightfall came, Gates was found miles away from the scene of battle. This ended his military career. He retired in disgrace to his Virginian estate, and two years later after freeing his slaves he removed to New York, where he remained until his death.

GELATIN. When you eat the quivering variously colored dessert so often served with cream in a jelly-like mound, you are making an intimate acquaintance with one of the many uses of gelatin—its use as a foodstuff, in puddings, jellies, soups, etc.

Gelatin is a hard, yellowish, semi-transparent substance obtained chiefly from animal tissues, especially bones, horns, and hoofs. There are a number of processes for producing it, and a number of varieties, ranging from glue to table desserts. When bones are soaked in weak acid, certain parts dissolve and leave behind the bone cartilage; and when this is boiled it dissolves and forms gelatin. Vegetable gelatin is manufactured from seaweed and Irish moss.

In its crude condition gelatin is cut into slices, dried, and sold as glue. Sometimes gelatin is purified by dissolving in hot water and adding alcohol. Purified with sulphurous acid it is used for making the tough, whitish, semi-transparent substance called "isinglass" so valuable in refining liquors and stiffening food. The best isinglass and edible gelatin is obtained from the air bladder of fish. It was formerly obtained solely from the sturgeon of Russia, but it is now procured also from the cod and other American fish. (The name isinglass is often incorrectly applied to the mineral mica, which splits into thin sheets closely resembling the gelatin isinglass.)

Gelatin is one of the ingredients of printing-press rollers. It is used as a coating or capsule for pills, and is employed in dyeing and tanning, in making paper, waterproofing material, India inks, artificial leather, and artificial silks. Gelatin also forms the base in which are imbedded the sensitive chemicals used in coating photographic plates, films, and papers.

GLITTERING PEBBLES *More Precious than Gold*

GEMS. In the India of a few centuries ago, princes filled their treasure chambers with precious stones almost by the bucketful. Many of these priceless jewels—such as the pearl scarf of the Maharaja of Indore, worth perhaps $3,300,000—have descended through dynasties of Hindu rajas and Mogul emperors to the native princes of today.

BIRTHDAY STONES

The following are the birthday stones and their supposed significance:

January	Garnet	Constancy
February	Amethyst	Sincerity
March	Bloodstone	Courage
April	Diamond	Innocence
May	Emerald	Success in love
June	Agate	Health and long life
July	Carnelian	Content
August	Sardonyx	Conjugal felicity
September	Chrysolite	Antidote to madness
October	Opal	Hope
November	Topaz	Fidelity
December	Turquoise	Prosperity

Although India is famous beyond all other countries for its superb collections, gems and precious stones have been valued highly in all lands and ages. They are ranked according to color, luster, hardness, durability, and rarity. Diamonds, rubies, sapphires, emeralds, topaz, garnets, and chrysoberyl rank first in value. In the second class are turquoise, tourmaline, opal, agate, jasper, and onyx; in the third are the less precious but still ornamental stones such as lapis lazuli and moonstone. Other jewelry substances are the costly pearls and the less valuable coral, derived from animals; and amber, a fossil resin of vegetable origin.

The sparkling diamond, the "king of gems," which is pure crystallized carbon, is the hardest of the precious stones (*see* Diamond). It has been estimated that there are less than 47,000,000 carats of cut and polished diamonds in existence, and that these altogether would weigh only $10\frac{1}{2}$ tons, and could be packed into a large clothes closet!

Rubies and sapphires rank next for hardness. Both are transparent varieties of the mineral corundum, which is aluminum oxide. Emery is an impure form of the same mineral (*see* Emery). The best rubies —which are usually a pure carmine red—come from Burma, Siam, and Ceylon. Pink, purple, and violet rubies are also found, but those most valued are of the peculiar tint called "pigeon's blood." Large rubies are very rare, and specimens of three or four carats are worth from two to five times as much as diamonds of the same size. Although they are seldom more than eight or ten carats in weight, Gustavus III of Sweden is said to have given one as big as a pigeon's egg to Catherine of Russia. Two of the largest rubies known, belonging to the ruler of Bishnupur in India, weighed $50\frac{3}{4}$ and $17\frac{1}{2}$ carats, respectively. The so-called rubies found in the western United States, South

Africa, and Australia are a fine variety of garnet.

The pretty bright blue sapphires, which are found mainly in Siam, Burma, Ceylon, and Cashmere, are valued chiefly for quality rather than size. Specimens of great size have been found, one weighing as much as 951 carats. Montana yields a considerable number of sapphires, nearly all of which are used for bearings in watches and delicate instruments. The beautiful deep green emerald is the same material (a silicate of aluminum and glucinum) as beryl, which varies from blue to light green and yellow. Flawless emeralds are rarely found and rank with the diamond in value. The modern supply comes for the most part from Colombia. The ancient supply came chiefly from Upper Egypt, where mines are still worked. Some specimens are of great size, one found in the Ural Mountains weighing 6¾ pounds.

IN A RUBY MANUFACTURING PLANT

A prosaic looking outfit, isn't it? So far as appearances go, this might be behind the scenes at a soda fountain, but what is really taking place is that certain substances containing aluminum and chromium are being subjected to intense heat in little electric furnaces, after which they crystallize into artificial rubies. They are of exactly the same composition as real rubies. Think of it! Those beautiful gems are composed largely of aluminum, the same material of which kitchenware is made, while it is the chromium, another common metal, which gives them their brilliant red color.

The trade in gems, cut and uncut, both mounted and unmounted, is enormous. In New York City alone there are said to be more than $250,000,000 worth of cut gems, while the total value of precious stones in France is about a billion dollars. The United States normally produces one-third of a million dollars' worth of precious stones, chiefly sapphire, quartz, tourmaline, and turquoise, and found mainly in Montana, Nevada, California, Colorado, Maine, and Arizona.

Rubies and sapphires are now manufactured in the electric furnace. These synthetic stones, as they are called, have nearly all the qualities of the natural stones. Even experts find it all but impossible to distinguish the artificial specimens from the natural. Millions of carats of rubies and sapphires have been manufactured, chiefly in France and Switzerland, where electric current is cheap. The Orient is a large buyer of these stones. Real diamonds, too, have been made in the electric furnace, but of such microscopic size and at such great cost as to make the process commercially impracticable.

Imitation gems, as distinguished from synthetic gems, have been made since the earliest times. The usual basis is a kind of hard, clear, and brilliant glass called "paste" or "strass," which has a high proportion of oxide of lead in it. Imitation sapphires are made 1,000 parts paste and 25 parts of oxide of cobalt, while imitation garnets are produced by mixing 1,000 parts paste and a variable quantity of purple of Cassius. Imitation diamonds are made of pure paste cut into brilliants and roses. Immense quantities of these paste gems are made in large factories in France and elsewhere, to be used in cheap jewelry. They can be readily distinguished from real stones by their softness and lack of depth and brilliancy.

Gem cutting and engraving—the lapidary's art—has been practiced from very remote times (*see* Cameo). Great numbers of precious and semi-precious stones have been found in Mesopotamia cut into cylindrical form and bearing engraved figures. When rolled over the soft clay of writing tablets, these cylinders left the design in relief to serve as a personal seal. This art had been developed to a high degree of perfection by the ancient Sumerians at least as early as 3000 B.C. Seals engraved with the sacred beetle, called scarabs, were in use in Egypt by the same time.

Of the many other precious and semi-precious stones, pearls are the most prized. These beautiful gems of white, pink, black, etc., with their play of delicate tints, are secretions of the lining membranes of various kinds of shellfish. The pearls of commerce come chiefly from the pearl oyster found mostly in the Persian Gulf and on the west coast of Mexico (*see* Pearls).

Topaz is a translucent gem of a sherry yellow color (although sometimes pale blue, green, brown, or white) the finest of which come from Brazil or Ceylon. *Garnet*, usually red but sometimes brown, yellow, green, or black, is found particularly in crystalline rocks of Bohemia, Ceylon, Peru, and Brazil. *Chrysoberyl* is a bright very hard rare stone of yellow, brown, and light green. *Turquoise*, a hard greenish-blue stone (a phosphate of alumina colored by copper), is found mostly in Persia. *Opals* are bluish, black, or yellowish-white stones composed mostly of silica and water, with a beautiful play of brilliant colors. The finest come from Hungary. Common opals are white, yellow, green, red, and brown without any play of colors. *Jet*, a black polished mineral (a variety of lignite), is often used for mourning jewelry. *Lapis lazuli* is a beautiful azure-colored mineral much used in ornamental and mozaic work, and now manufactured on a large scale at a low cost. *Jade* is a hard green stone much prized in oriental countries for making ornaments. *Amethyst*, a purple variety of rock crystal or quartz, is found in Brazil, Ceylon, and elsewhere. *Agate* is a kind of *chalcedony* or uncrystallized quartz with bands of variegated colors or the colors arranged in a cloudy or mosslike formation. Gray, brown, red, black, and white are the most common colors. They are found especially in Germany, Scotland, South America, and many parts of the United States and Canada. Especially prized is the black and white banded agate, called *onyx*, and the red and white known as *sardonyx*, from which cameos are cut. *Tourmaline* is found in granite, gneiss, and mica schist. It occurs in many colors, and there are also colorless varieties. Sometimes two colors blend into each other in the same stone, or there will be one color inside and another outside.

JUST OUT OF THE FIRE

Artificial rubies are built up in the furnace by allowing the melted chromium and aluminum, as formed, to drip on a matrix, thus building up the gem as the drip of water builds up an icicle on the edge of a roof.

GENEVA, SWITZERLAND. "A bird's nest of a place; the most lovely spot and the most notable, without any possible dispute, of the European universe." This is what the great art critic Ruskin said of Geneva. The town nestles in a cup of the Alps at the lower end of famous Lake Geneva (*Lac Leman*), whence the Rhone River issues as clear and blue and shimmering as a butterfly's wing. Sweeping under its white bridges, the river forms two islands, one of which is called the island of Jean-Jacques Rousseau, after the great revolutionary writer, who was one of Geneva's many famous sons. The town is as clean and shining as the river, with broad promenades by the lake and streets of handsome white stone houses. And when at sunset the snow-clad peak of Mont Blanc, 40 miles to the southeast, becomes visible among its lesser sisters in delicate rose and white and lavender, the spectacle is one of almost unearthly beauty.

Lying nearly in the center of Europe, and one of the gateways to Switzerland—"the world's playground"—Geneva has long been a favored resort for travelers. Its beauty, its ancient traditions of cul-

BEAUTIFUL LAKE GENEVA AND ITS LOVELY CITY

We are looking across the southwestern end of the crescent-shaped Lake Geneva from one of the public gardens of the city of Geneva. On the opposite bank is the newer part of the town, where are situated the many hotels patronized by tourists. Back of the city rise great barren rocks and beyond them glitter the eternal snows of the Mont Blanc chain. It is at this point that the Rhone River runs out of the lake.

ture, its fine old university, have induced many citizens of other lands to make it their home; and its jealous defense of the right of political asylum has made it a harbor for revolutionists, radicals, and political refugees. During the World War of 1914–18 it was a veritable hotbed of plots and counterplots by emissaries of the warring countries. Since the neutrality of Switzerland is guaranteed by international agreement, Geneva has been the scene of several important diplomatic meetings. These include the arbitration of the *Alabama* claims between the United States and Great Britain, and the international conferences of 1863 and 1868, which resulted in the organization of the International Red Cross. At the close of the World War it was chosen as the capital of the new League of Nations.

Geneva is French in language and in customs, for it is almost completely surrounded by France, only a narrow strip connecting it with the rest of Switzerland. Its principal industries are the manufacture of watches, scientific instruments, and jewelry.

In the days of the Roman Empire Geneva was already a city. At the close of the Middle Ages the citizens freed themselves from the feudal control alike of their bishop and of the neighboring house of Savoy, and established a self-governing republic. John Calvin, the great religious reformer, made Geneva in the latter half of the 16th century the leading center of Protestantism. The most celebrated event in the city's history was the repulse of a surprise attack on the city in 1602 by the house of Savoy, its hereditary enemy. In memory of the event the Genevese still hold a festival every year. Napoleon Bonaparte annexed Geneva to France in 1798, but with his fall in 1815 the city regained its freedom. Since that date it has been a part of Switzerland, with whose confederated cantons Geneva had been politically allied for nearly three centuries before the French conquest. Population, about 140,000.

Beautiful Lake Geneva, 45 miles long, is the largest lake in Switzerland. At the other end from the city of Geneva, near Lausanne, is the Castle of Chillon, made famous by Byron's poem, 'The Prisoner of Chillon'.

GEN'OA, ITALY. Since early historical times Genoa "the Superb," rising from the Gulf of Genoa in beautiful relief against the sharp slopes of the Apennines, has been one of the most important seaports on the Mediterranean Sea and a gateway to northern Italy. From its great harbor hundreds of noted sea captains have set sail on romantic adventures of conquest and commerce in distant lands, making it a fitting birthplace for its most famous citizen and navigator, Christopher Columbus.

Stretching upward from its magnificent quays and docks which line the 600-acre harbor, the city covers the slopes of the surrounding hills with noble palaces and ancient churches, terraced gardens and orange groves, while against the distant sky are outlined its protecting chain of strong fortifications stretching for 11 miles along the higher peaks.

The prosperity of Genoa in earlier times rested largely upon its commerce with the lands of the Eastern Mediterranean, and through these with India and China. Booty from military expeditions, chiefly against the Moors in Spain, was also an important source of wealth. Today its importance is due to a large export business in silks, olive oil, rice, wine, coral, paper, soap, macaroni, and marble.

After passing through the hands of the Lombards and the Franks, Genoa became an independent city upon the breakup of Charlemagne's empire. It fought a long series of wars with Pisa, its southern neighbor, in which the latter was crushed in 1284. A similar series of wars, due to commercial rivalry with Venice, ended with Genoa's disastrous defeat at Chioggia in 1380. The aristocratic and the democratic factions were in constant turmoil up to the 16th century, when the autocratic rule of the doges began.

The noted Bank of Genoa, founded in the 12th century, presented in the Middle Ages the spectacle of a small group of merchant capitalists who virtually dictated laws and gave orders to the government. This historic wealth is reflected today in an imposing array of fine churches, palaces, schools, libraries, and museums. The city has a flourishing university, founded in 1471. Corsica, the last of the city's foreign possessions, revolted and was taken by France in 1768. Sardinia-Piedmont acquired the city in 1815, and it became a part of the kingdom of Italy with the union of the peninsula under the Piedmontese kings. Population, about 300,000.

GENTIAN (*gĕn'shŭn*). When the September woodland borders are touched with gold and red and the meadows and thickets, browned by the hot summer sun, are cooled by the autumn breezes, a flower of heavenly blue rises among the bright goldenrod and bursting milkweed, waving and nodding its proud head before the gay world. Long long ago, so it is said, Gentius, king of ancient Illyria, discovered that a medicine could be produced from the root of this lovely plant, and it is in his honor that it is named. In Switzerland, on the green sunlit slopes of the Alps, whole pastures are blue with it.

The Gentian flower, named after an ancient king, unfolds its beautiful blue blossoms in the fields as a sign that Fall has come.

The fringed gentian of North America, which becomes rarer each year owing to thoughtless gathering, has a tiny fringe around the edge of its four pretty petals. We find these bright blue flowers growing from Quebec southward to Georgia and west beyond the Mississippi, blooming from September to November. When the darkness falls they fold their beauty until the smiling sun beckons them out again:

> Then doth thy sweet and quiet eye
> Look through its fringes to the sky,
> Blue—blue—as if that sky let fall
> A flower from its cerulean wall.—*Bryant.*

Another of the more than 300 species is the closed gentian, whose clustered flowers never open. A few rare species are white, yellow, or red, the latter being found in the Andes. In the Catskills of New York a five-flowered gentian of conspicuous yellow is found.

Scientific name of fringed gentian, *Gentiana crinita.* Flowers solitary and stiffly erect at the end of a long stalk; calyx of 4 unequal lobes; corolla, funnel form; 4 stamens inserted in the corolla tube, and 1 pistil with 2 stigmas. Stem from 1 to 3 feet high, leafy and branched. Leaves opposite, acutely tipped on top, gradually broadening to heart-shaped.

Our WIDE, WIDE WORLD—*Its Lands and Peoples*

Vast and Varied Panorama Presented in the Study of Geography—Getting at the Secret of the Growth of Cities—Thrilling Stories Back of the Maps of the World

GEOGRAPHY. On the other side of the earth, in the hot wet island of Borneo, are the savage Dyaks, who live in houses set on piles along the rivers, hunting game with spear and blowgun and planting crops of rice and vegetables. Up in arctic Labrador the sturdy squat Eskimos dwell amid snow and ice, getting their food and clothing from the animals of sea and land. The patient Chinaman, bent with toil, works day and night in his little terraced rice field, up to his knees in water, using his bare feet to pack the mud around the young rice plants and to pluck the weeds. So many are the mouths he has to fill and so tiny his field that the failure of a crop means death to hundreds of thousands.

Along the Nile the Egyptian fellah laboriously lifts the water of the river by long sweeps into the ditches that irrigate his field. On the vast prairies of North America farmers drive great gang plows drawn by six, eight, or ten horses or by mechanical tractors, producing enormous crops of grain to feed the hungry world. On the immense treeless steppes of central Asia, where there are no mild ocean breezes to temper the cold of winter and the extreme heat of summer, the Kirghiz and Mongols wander about pasturing their flocks and herds on the tall grasses. In the sweltering fever-ridden jungles of the Amazon, naked savages, too low in civilization to have learned to plant crops, live on the fruits and nuts of the trees, the fish of the rivers, and the animals they slay; while only a short distance to the west, still near the Equator, the mountain shepherds of Bolivia dwell on the lofty heights of the Andes, where it is so cold only the hardiest crops will grow and men would perish but for the food and clothing they get from their flocks of llamas.

How Geography Helps Tell Men's Fortunes

Why do the peoples of the world differ so widely in the way they live, in dress, appearance, customs, intelligence? The fascinating science of geography tells you. It shows how land and ocean, rivers and mountains, plains and valleys, temperature and wind and rainfall, in large measure control the ways in which men live and the degree of civilization they attain.

Here and there men have come together into great cities, each with an individuality of its own and each crowded with interest to the wide-awake mind. London, Paris, Constantinople, Peking, Cairo, New York, Chicago, Quebec, Bombay, Buenos Aires—every name is a flash of romance and mystery. Why did these great cities spring up at just those spots? Geography tells you. It shows how some, like New York and London, owe their existence chiefly to their excellent harbors. Others, like the manufacturing cities of the Atlantic states, grew up on the edge of the Piedmont plateau—the broken hilly country between the coastal plain and the inland mountains, where the abundance of water-power was favorable to the growth of manufactures. Some, like Chicago and Winnipeg, have come to greatness because they stand at strategic points on great trade routes. Others, like Pittsburgh and Sheffield, have been made by the proximity of great iron and coal deposits.

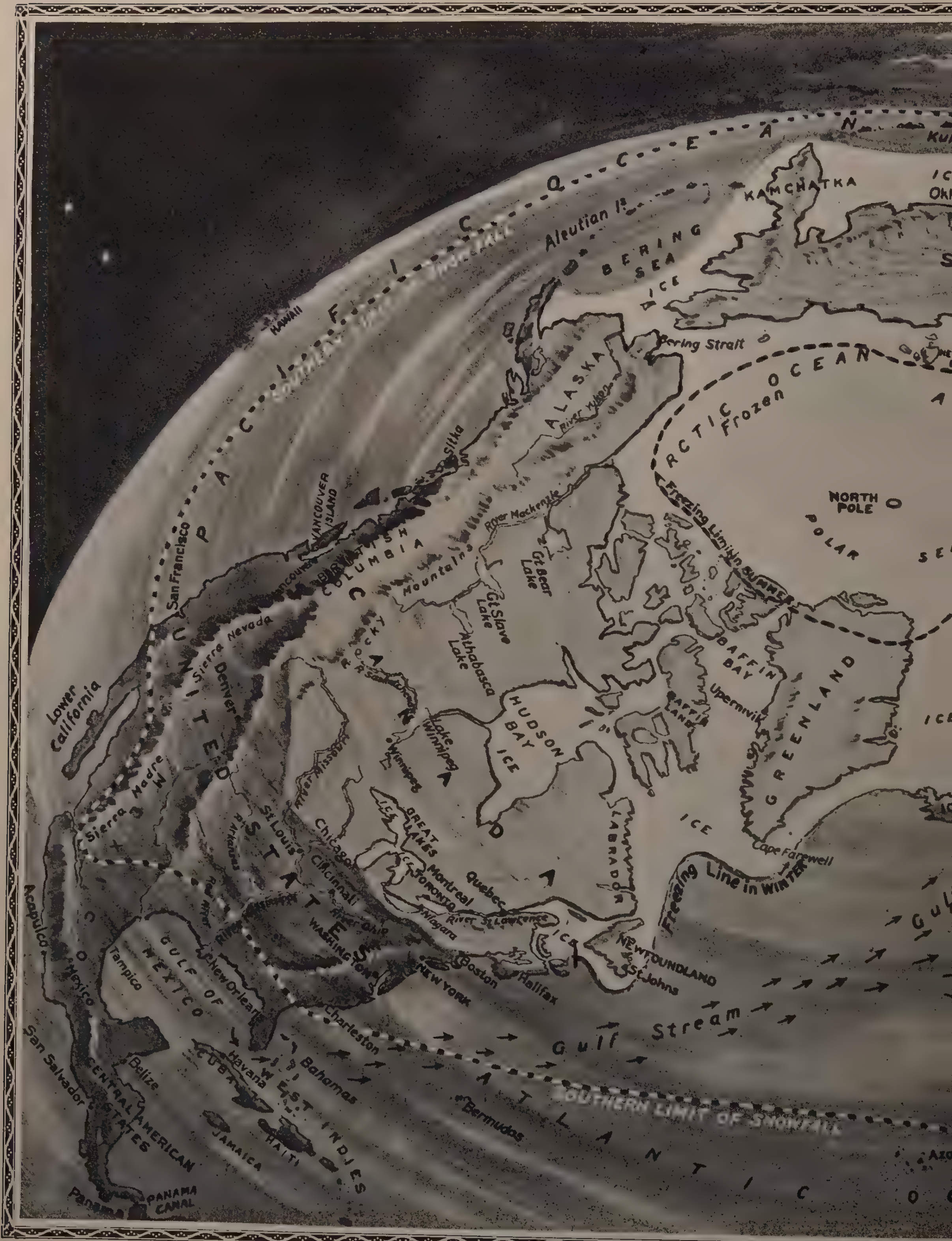
And so one might go on for pages, merely suggesting some of the myriad interesting things the study of geography has to tell us about the earth as the home of man. But this, while the most interesting and important of the aspects of geography, is only a part of the story. As its name shows, geography (from the Greek words meaning "earth" and "to write") is a description of the earth. Its vast subject-matter naturally falls into several main divisions, which are variously classified. The simplest division is into mathematical geography, physical geography, and biogeography, or the geography of living things.

Relation of Geography to the Story of the Stars

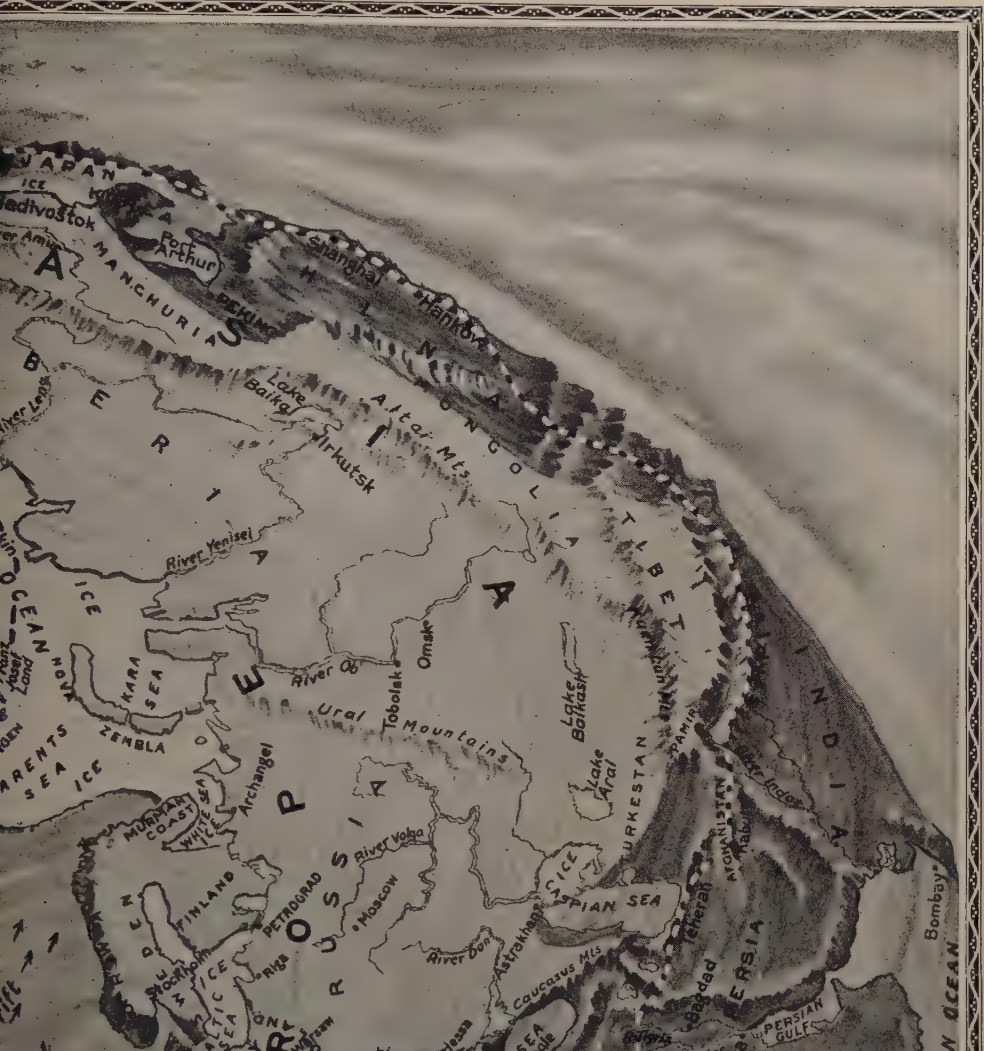
Mathematical geography treats of the form, size, and movements of the earth from the standpoint of mathematics. In considering the movements of the earth and its place in the solar system, it is closely connected with astronomy. And since it also has to do with the measurement of the earth and the various methods of representing its surface on maps, it is related to surveying and cartography or map-making.

Physical geography, which is practically identical with physiography, as the term is commonly used, treats of the physical features of the earth—land, sea, and atmosphere. Geology, oceanology, climatology, and meteorology all contribute to supply the data of this department (*see* Physiography).

THE HUGE STAGE ON WHICH



LIFE'S DRAMA IS PLAYED



Thinking of the Earth as the home of man, and Geography as the science that deals with it as such, what a magnificent subject for investigation and reflection this view of the globe provides us! Here we have the theater on which almost the entire drama of the world's history has been enacted.

Beginning with the cold and barren region in which the Eskimos, the Lapps, and other Arctic peoples have made such difficult progress, and have overcome the obstacles of climate and situation in so many ingenious ways, we pass down through the temperate regions where the civilization of today has reached its highest point. Further down we reach lands with climates so mild and friendly that fewer obstacles were offered to man's progress. Here the oldest civilizations grew up, the civilizations of Egypt, Babylonia, Greece, and Rome.

In imagination we can people this map with the Siberian hunters in their land of snow and ice, with the prosperous farmers busy at their great harvest on the prairies of North America, with the patient Chinamen toiling in their terraced rice fields, with the Egyptian "fellahs" patiently lifting the Nile water with their long sweeps, and with the wandering Mongols driving their flocks and herds over the immense steppes of Central Asia. With this picture before us, we can reflect "how land and ocean, rivers and mountains, plains and valleys, temperature and wind and rainfall control the ways in which men live."

Finally comes the great department which treats of the living things that dwell on the earth, their distribution and life conditions, culminating in the geography of man. Man is the animal that has learned to conquer and control geographical conditions. By great engineering works he modifies the earth's surface to his advantage. He drains and irrigates the land, tunnels through mountains, reclaims land from the sea, and even severs continents by canals. By cultivation and breeding he changes the distribution of animals and even produces new varieties. All other branches of geographical study are subordinate to this crowning department and focus in it. Hence human geography, as it is sometimes called, is further divided into various subdivisions, such as political geography, which deals primarily with the distribution of the human race, and economic or commercial geography, which treats of the manufacture and distribution of the world's products (*see* Commerce; Transportation).

The progress of geographical knowledge has depended largely on the progress of discovery. The Phoenicians were the first people who communicated to other nations a knowledge of distant lands. Their voyages before the time of Homer, through the Euxine, the Mediterranean, and even into the Atlantic, form the first link of the great chain of discovery which, centuries later, was extended by Columbus to the shores of America. Travelers like the Greek historian Herodotus did much for the advancement of geography, as did also the exploring and surveying expeditions of Alexander the Great. At the same time Pytheas, the Massilian navigator, was following the path of discovery in the north, possibly as far as Iceland. About 200 B.C. Eratosthenes first used parallels of longitude and latitude and made maps on mathematical principles. By this time the old idea of the earth as a flat circular shield surrounded by a rim of water had given place to the belief that the earth is a sphere, revolving with the surrounding atmosphere on one axis. The practical genius of the Romans led them to make a study of the resources of the countries they conquered, which did much for geography. Their greatest work was a survey of the whole empire, including a description and measurement of each province, which was made under Caesar and Augustus. In the 2d century of our era Ptolemy wrote a work on geography, in eight books, which remained the authority for many centuries.

How Men Put New Countries on the Map

The travels of the Venetian, Marco Polo, in the 14th century opened new fields of inquiry, and the close of the next century was marked by the discovery of the American continent. Within 30 years the whole coast of America, from Greenland to Cape Horn, had been explored; the Pacific Ocean had been navigated by Magellan and the world circumnavigated by his ship; the coasts of eastern Africa, Arabia, Persia, and India had been visited; and numerous islands in the Indian Ocean discovered. The attempts to find a northwest passage to India increased the knowledge of the Arctic regions. In the 17th century the Dutch made known to the world the Australian Islands (which the Portuguese had discovered a few years before). Captain Cook in his three voyages completed our knowledge of most of the Pacific lands.

The Great Work of the 19th Century

At the beginning of the 19th century explorers were familiar with the outline of the continents and most of the islands, but four-fifths of the land area was still practically unknown. There was only the scantiest knowledge of central and eastern Asia, and of the interior of the Americas. Africa was still truly the "Dark Continent." Most of the Polar lands were still undiscovered and the existence of the vast Antarctic Continent was derided as an empty fable. By the close of the century, most of these immense gaps in geographical knowledge had been closed by the labors of such heroic explorers as Lewis and Clark, Fremont, Pike, and Selkirk in North America; Parry, Franklin, the two Rosses, McClure, Kane, Nansen, Peary, and a score of others in the Polar regions; Livingstone, Stanley, Burton, Speke, and Schweinfurth in Africa; Younghusband and Sven Hedin in Asia. But it was not until our own century that the veil was torn from the two chief objects of exploration—the North Pole, attained by Peary in 1909, and the South Pole, by Amundsen in 1911 and Scott a month later (*see* Polar Exploration).

The work of making geography is still going on. There are vast tracts, notably in northern Asia, in Africa, in South America, and in northern Canada, of which we have only the scantiest knowledge. In the study of the ocean and the atmosphere too there is still much to be done.

In this making of geography, geographical societies and associations for securing and spreading geographical knowledge have performed an important part. The first of these societies was founded in Paris in 1821. The first society in the United States was the American Geographical Society, founded in 1852, and the next was the National Geographic Society, founded in Washington in 1888.

Among the members of these associations are men undertaking distant travels, in some cases at their own expense and in others aided by funds from the society or grants from the government. The information so collected is given to the world in lectures and in books or periodicals published by these organizations. Photography has been a great aid in recent years not only as a reliable and quick means of recording the striking features of a country and its inhabitants, but as a rapid and accurate method of topographical surveying.

The volumes of this work cover in their alphabetical place practically every topic touched in geography—continents, countries, cities, states, rivers, lakes, oceans, mountains, etc. In the last volume the topics are arranged in their proper order and related so that the reader can survey the whole field of geography.

The WONDROUS STORY *We* READ *in the* ROCKS

A Young Science that Peers Deep into the Abysses of the Ages—The Biography of Mother Earth and How to Read It in the Landscape and in the Ground beneath Your Feet

GEOLOGY. Geology is the science which deals with the history of the earth. It is the task of geology not simply to recite the history of the earth so far as it is known, but to show how this history became known and how the limits of knowledge are being extended. Geology is a young science, and in its study at the present time it is needful to take account of the limitations of present knowledge as well as of the knowledge itself.

Everything which throws light on the history of the earth falls within the field of geology. The history of the atmosphere and the history of the ocean are really parts of geology, since the atmosphere and the ocean are parts of the earth. The popular impression, therefore, that geology has to do only with the rocks of the earth is not altogether adequate. The rocks of the earth, to be sure, furnish the larger part of the data for unraveling the history of the earth, though they are not the only sources of information. It is to be remembered, too, that when the geologist studies the rocks, he studies them for the light they can be made to throw on earth-history, rather than for their own sake.

How Earth Rehearses the Story of Her Life

In working out the history of the earth, so far as it has been worked out, the line of approach has been through the study of the changes which are now taking place on the earth's surface. The rain falls on the land, and some of it gathers into streams, and the streams flow into the sea. In the flow of the water the substance of the land is worn away. The material is carried to the sea and deposited there in the form of gravel, sand, mud, etc. The sand and mud need nothing but cementation to become sandstone and shale, two of the commonest sorts of rocks found on the land. The process of cementation is now going on by natural means in many places. In the sand and the mud, as they are deposited in the sea, shells of various animals are imbedded. The shale and sandstone of the land also contain shells and other traces of marine animals known as fossils (*see* Fossils). Hence it is inferred that the sandstone and shale, as well as certain other sorts of rock found in the land, originally were deposited as beds of sand and mud in the sea, and that they have since been elevated so as to become dry land.

The activities of other surface agencies are studied similarly. The detailed study of the work now being done by rain and rivers, underground water, waves and currents, the atmosphere, glaciers, changes of temperature, gravity, organic agencies, and all other forces and activities operative on the surface of the earth, has taught geologists how to interpret the rocks formed in ages long past. It is by the interpretation of the recorded results of the past, in the light of the processes now taking place, that the science of geology has grown up. The study of present processes is becoming more and more exhaustive, and the application of this increased knowledge of present processes to the records of the past is continually enlarging and perfecting our knowledge of the earth's history.

The Mystery in the World's Beginnings

Geology really begins with the origin of the earth, and at this point it touches the field of astronomy. The early ages of the earth's history are as yet speculative. There seems to be good reason for doubting the truth of the "nebular hypothesis," which was long regarded as satisfactory. The only rival hypothesis which has been framed is the "planetesimal hypothesis," which supposes that the earth is made up of an aggregation of small bodies comparable to the meteorites and shooting stars which daily reach the earth by millions at the present time. (*See* Meteors and Meteorites.) While the stages of the earth's history preceding the beginning of sedimentation are largely conjectural, many lines of investigation are being pursued which ultimately may throw much light on the early and obscure stages of the earth's development. The general outlines of this history since sedimentation began are fairly well understood.

The rocks of the earth which contain the principal records of the earth's history are of three great classes: (1) igneous rocks, or those which represent solidified lava; (2) sedimentary rocks, as shale, sandstone, conglomerate, etc., most of which are made up of fragments of older rocks; and (3) metamorphic rocks, which may have been so far altered by various means that they are now very unlike the materials from which they were first made. In the metamorphism of rocks, pressure is the most important agent. Chemical change, under the influence of moisture, is probably second in importance; and heat third. A special class of sedimentary rocks is due to life. Here belong most limestones, made of shells, corals, etc.; coal, of plant origin; and a number of lesser formations.

The composition, position, and structure of these several sorts of rock and their fossil contents, so far as they contain fossils, interpreted in the light of processes now taking place, allow geologists to infer the conditions under which the various sorts of rocks are made. When geologists are able to tell what the conditions were on every part of the earth at every period of the past, the science of geology will be complete.

Among the many branches of the science, economic geology is one of the most important. It deals with the materials of the earth's crust which are commercially valuable, and has to do with ores of all sorts, with coal, with building stone, with clays which are valuable for the manufacture of brick and pottery, and the like. It deals also with materials which can be used for pigments; sand, which can be used for glass; with precious stones; with abrasive materials; with asphaltum, petroleum, natural gas, salt, fertilizers, etc. One function of economic geology is to determine the origin of these substances and, so far as possible, the laws which govern their distribution.

Five Vast Chapters in Earth's Story

Geologic time is divided into five eras, and most of these are divided into several periods, as shown in the following table reading from the present to the remote past:

ERAS	PERIODS	
Cenozoic	Quaternary (including glacial)	
	Pliocene	Tertiary
	Miocene	
	Oligocene	
	Eocene	
Mesozoic	Upper Cretaceous	
	Lower Cretaceous	
	Jurassic	
	Triassic	
Paleozoic	Permian	Carboniferous
	Pennsylvanian	
	Mississippian	
	Devonian	
	Silurian (=Upper Silurian)	
	Ordovician (=Lower Silurian)	
	Cambrian	
Proterozoic	Algonkian	
Archeozoic	Archean	

The Archeozoic era was the time occupied in the making of the oldest known system of rocks. The Archean rocks are mostly metamorphosed igneous rocks, though with them are some metamorphic sedimentary rocks. Fossils have not been found in this system of rocks, but it is certain that life existed before the close of this era.

The Proterozoic era is the time during which were deposited the great systems of rocks lying above the Archeozoic and below the oldest rocks containing abundant fossils. The rocks of the Proterozoic era are mainly sedimentary, though igneous rocks have great development locally. The formations of the Proterozoic era are many thousands of feet thick, though considerable portions have been removed by erosion. The Proterozoic era was perhaps as long as all subsequent time. Some forms of life existed during this era, as is shown by the few fossils which have been found in the rocks, and by the nature of some of the formations, even where fossils are wanting. For example, there are black shales and graphitic slates, the carbon of which probably is of plant origin. The Proterozoic (Algonkian) rocks of the Lake Superior region contain rich deposits of iron and copper.

The Paleozoic (formerly called Primary) era was the time when the several systems of rocks bearing the names Cambrian, Ordovician, Silurian, Devonian, Mississippian and Pennsylvanian (Carboniferous), and Permian were deposited. The time occupied in the deposition of each of these systems is a period. These systems of rocks are mainly of sedimentary origin, and the materials of which they are composed were derived from the land areas existing when these systems were being laid down. Most of the materials of the systems were washed down from the land to the sea, and there deposited. The several systems of Paleozoic rocks are distinguished from one another by their fossils. Thus, the fossils of the Cambrian system of rocks are sufficiently unlike those of the Ordovician system to be readily distinguished by those familiar with fossils.

Relics of the Pioneers in the Field of Life

Even at the beginning of the Cambrian period the range of life was great, all the great types which now live except the vertebrates being represented. Even the vertebrates may have lived, though relics of their existence have not been found. In this period trilobites and brachiopods seem to have been the most abundant and characteristic life. In the rocks of the Ordovician system fish remains have been found, and also relics of air-breathing life. Mollusks, crinoids, and corals lived in great profusion, in addition to the types of life which predominated in the Cambrian period. Most of the oil and gas of Ohio and Indiana come from rocks of Ordovician age.

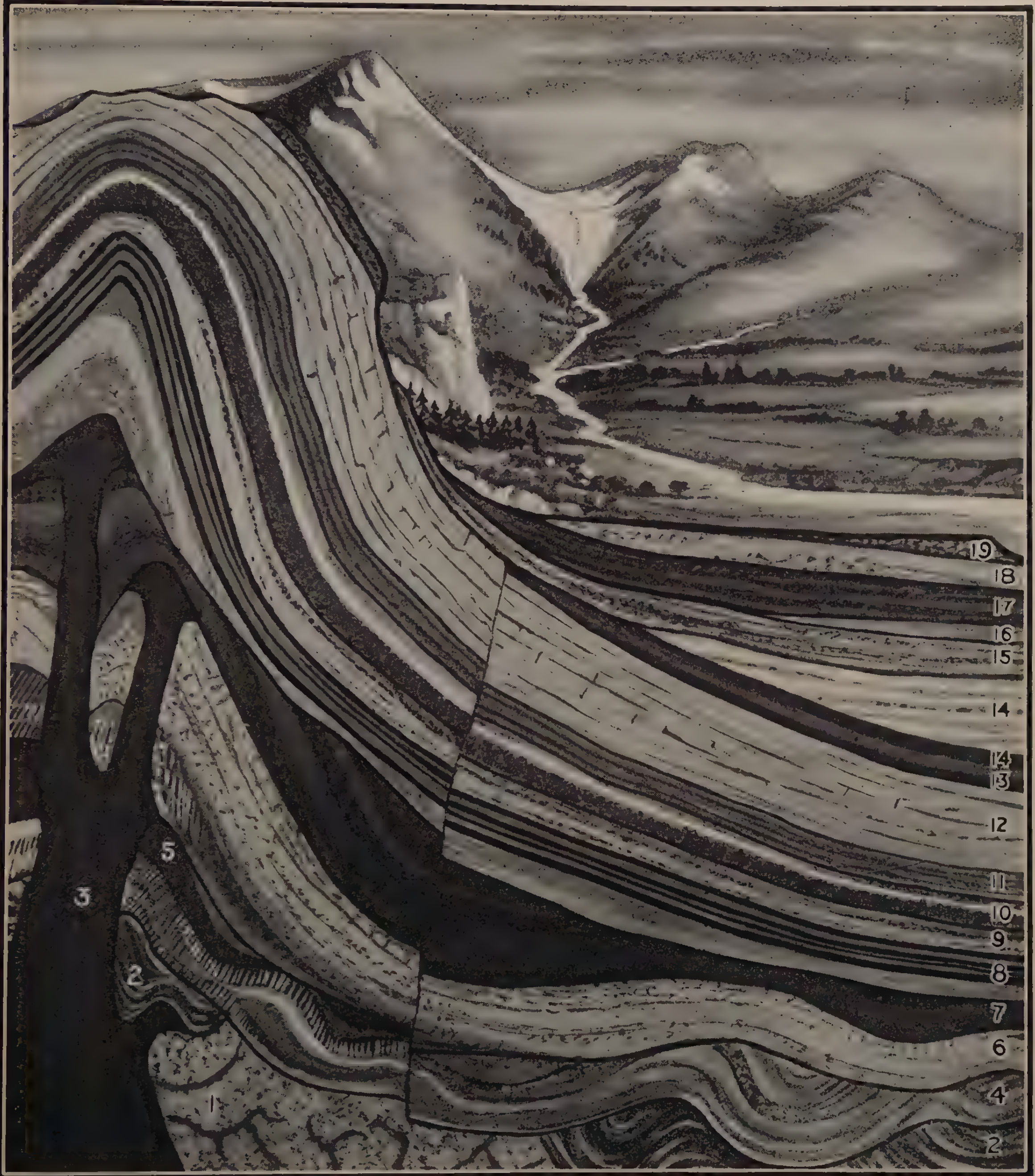
In the Silurian period the same general types of life were prevalent, but the species are so unlike those of the preceding period as to be readily distinguished by those familiar with fossils. The Devonian period is often known as the Age of Fishes, on account of the abundance of fish remains in the rocks of this system. It is far from certain, however, that fish were more abundant than now, and the variety of fish probably was less than at the present time. The Devonian was, however, the first period when fishes were abundant, so far as now known. The oil of Pennsylvania and Canada is largely derived from beds of Devonian age.

When Mother Earth Put in Our Winter Coal

During the Mississippian period, animal life seems to have become notably more abundant, and some beds of coal were formed, though coal is more characteristic of the next system. Much oil has been derived from the Mississippian system of rocks in Illinois. During the Pennsylvanian period there were extensive marshes in the United States and in some other parts of the world, in which vegetable matter accumulated in great quantity. These marshes (peat-bogs) subsequently were submerged, and the vegetable matter buried by mud, sand, etc., and ultimately converted into coal. Most of the coal of the United States east of the Great Plains was accumulated at this period. Plant life was abundant, but the plants were largely of types now extinct. Land animals of early reptilian types were common. The Mississippian and Pennsylvanian periods sometimes are called the Carboniferous period.

The Permian period represents a transition stage between the Paleozoic and the Mesozoic eras. In the Permian period there was extensive glaciation in Australia, South Africa, India, and South America.

THE STONE PAGES THAT TELL EARTH'S STORY



This picture illustrates how the old, old story of the Earth was written, so to speak, in the successive layers of stone laid down age after age and how geologists have been able to read it owing to the fact that the strata or "pages" are exposed by being wrinkled up into mountains and worn away by wind and weather and flowing streams. The great vertical crack running down the center of the picture is what is known as a "fault." The sudden development of such a break and the sinking of the rocks on one side is one of the causes of earthquakes, especially in mountain regions. In reading the stone book, you must start, not at the top, but at the bottom—the order in which the layers were formed. The oldest rock formation (1) consisting of gneiss, granite, and schist, is called Archean, meaning "ancient" and the era in which it was made is known as Archeozoic, meaning "ancient life." The next (2) is called Algonkian, formed in the Proterozoic era. The black vertical formation (3) is not one of the regular strata, but "trap rock" formed by molten stone which has welled up and broken through the layers above. The others in their order are Cambrian (4), Ordovician (5), Silurian (6), Devonian (7), Carboniferous or "coal-bearing" (8), which includes also Permian (9); then come Triassic (10), Jurassic, including Liassic (11), and Oölitic (12); Lower Cretaceous (13), and Upper Cretaceous (14); Eocene (15), which marks the beginning of the "Age of Mammals"; Oligocene (16), when the forerunners of the most of the present-day mammals began to take shape; Miocene (17), when such creatures as the mastodon appeared; Pliocene (18), which probably marks the beginning of the "Age of Man." The rock systems of the Quaternary period are the Pleistocene (19), formed about the time when man was struggling against the cave-bear and the mastodon, and the uppermost layer o. comparatively modern origin, called the Holocene or "Recent." These rocks differ from each other in chemical composition, the character of fossils they contain, and in various other ways; but when you remember that countless ages of earthquakes, upheavals, and subsidences have mixed them together, you will appreciate what a task it has been to read their lesson correctly.

The several systems of Paleozoic rocks have somewhat different distribution, and, since the area of the deposits of any period corresponds approximately with the submerged area of that period, the distribution of the several systems helps us to understand the relations of land and water during the several periods. In this way it is known that the relations of sea and land were different at different times. It would appear either that the continent repeatedly rose and sank, causing areas which were at one time submerged to become land, and vice versa; or that the sea-level itself rose and fell. If the sea-level rose, it would overspread the low lands; if it were lowered, it would cause areas which had been submerged to become land. How far the many changes in geography during the Paleozoic era were the result of land oscillations, and how far they were the result of oscillations of sea-level, never has been determined. So far as present knowledge goes, it would appear that the deep-sea bottom has at no time been land, and that the areas which were alternately above and below sea-level were low when they were land, and covered by shallow water only when they were submerged.

When Giant Reptiles Ruled the Land

The Mesozoic (formerly called Secondary) era, as the term indicates, was the era when life intermediate between the ancient and the present existed. This era is divided into several periods, as indicated above. The Triassic formations of North America are somewhat widespread in the western third of the continent, but have but little development in the eastern part. During this period reptiles perhaps were the dominant type of life. They were not only numerous but the individuals attained great size (*see* Animals, Prehistoric). The earliest known remains of mammals date from this period. Marine life abounded, but departed notably from the types which had prevailed in the Paleozoic era. Vegetation was abundant, but of types now extinct or rare.

The Jurassic period followed, and the distribution of its formations is similar to that of the Triassic formations. The life of this period was somewhat different from that of the preceding, though the same general types abounded. Reptiles were the most distinctive type, and they were even larger than in the preceding period. The oldest remains of birds yet found are Jurassic.

The Jurassic period was followed by the Cretaceous (Chalk) periods. In the early part of the first period chalk was not being deposited, but in the later part chalk deposits were in process of formation in many parts of the earth. The chalk deposits are made up, for the most part, of the shells of minute marine animals (*see* Chalk). The Cretaceous formations of North America are much more widespread than those of the Jurassic and Triassic periods. Their distribution indicates that a large part of the North American continent was submerged during part of the later Cretaceous periods. It was during the Upper Cretaceous that modern types of plants and fishes made their appearance. During the last stages of the Cretaceous periods extensive coal beds were laid down in the western United States.

Exit the Monsters; Enter the Mammals

The Cenozoic era, or era of modern life, followed the Mesozoic. Mammals, the earliest remains of which were found in the rocks of the Triassic system, abounded during the Cenozoic era, while the huge reptiles which had been especially characteristic of the Mesozoic era had disappeared. Reptiles still existed, but they were of relatively small types, and their numbers appear to have been few. As the Cenozoic era progressed, the forms of life approached more and more closely to those of the present time, and by the end of the Pliocene the life was nearly the same as that which now exists.

One theory ascribes this change from Mesozoic to Cenozoic life to a change in climate and ground surface. Before the change much of the ground was marshy, and since under such conditions size and power were more important than speed for survival, ponderous reptile forms dominated the earth. Then geologic changes drained off the water, created large areas of hard ground surface suited to running, and supplanted the luxurious swampy vegetation with modern "dry land" flowering plants. These changes gave the running types of animal, with their speed and ability to range far in search of food, an advantage over the clumsy giant reptiles, which therefore gradually became extinct.

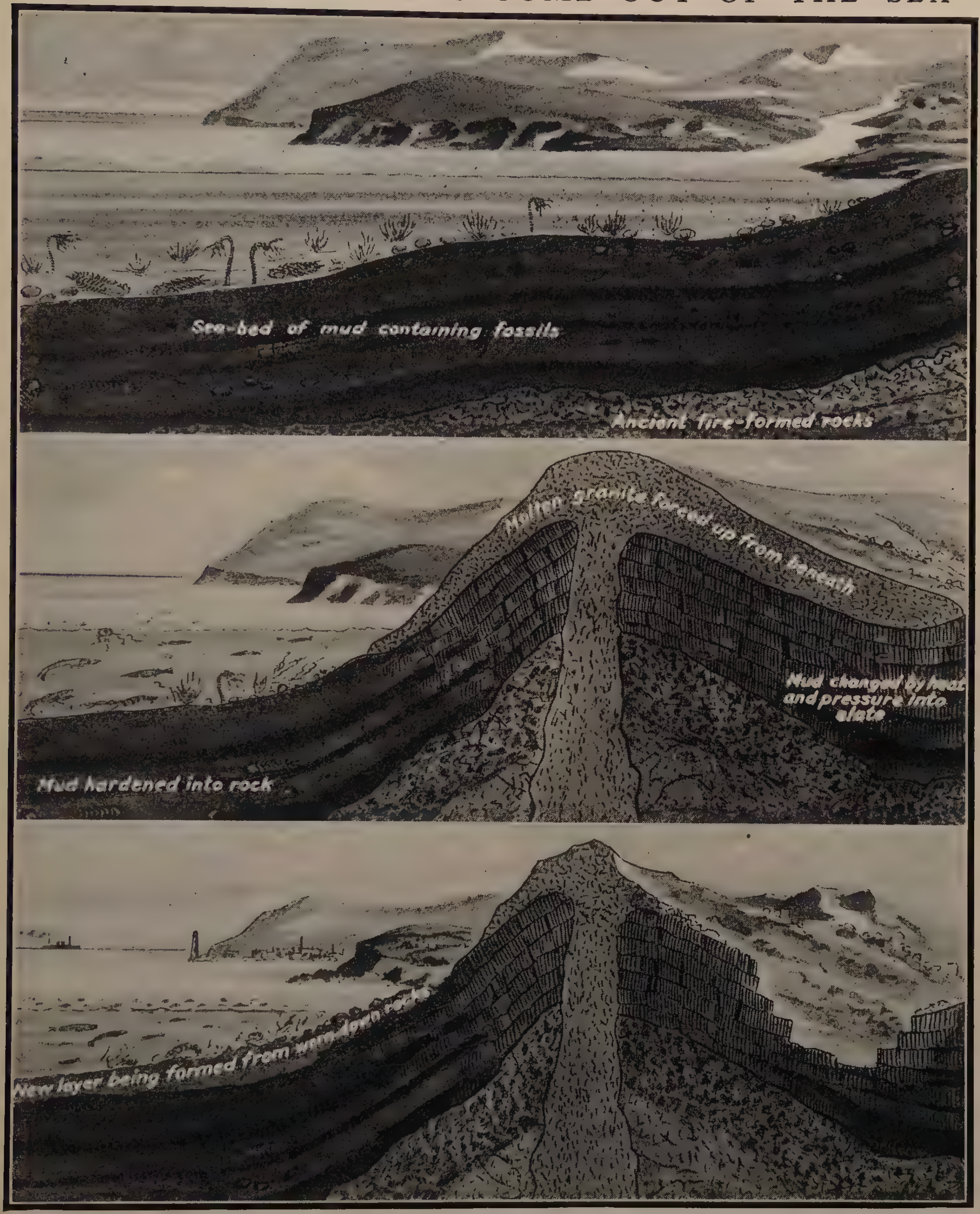
The Quaternary (Pleistocene) period was a remarkable one, on account of the great climatic changes which occurred at this time. The result of these climatic changes brought on a glacial climate, and an ice-sheet or series of ice-sheets covered something like 4,000,000 square miles in the northern part of North America. A large ice-sheet was developed, probably contemporaneously, on the continent of Europe, affecting especially its northwestern part (*see* Ice Age).

The duration of the earth's history is a matter which has received much attention, but no conclusions have been reached which can be relied upon, beyond the very general one that the history of the earth has been exceedingly long (*see* Earth). Various conjectures as to the number of years occupied in bringing the earth to its present condition have been made. They range from 25,000,000 years or so to 1,500,000,000 since the time of the formation of the oldest rocks now accessible. As stated above the Archeozoic era probably was longer than all subsequent time put together. The Proterozoic era was perhaps as long as all that followed. The Paleozoic era was perhaps two or three times as long as the Mesozoic, and the Mesozoic probably was considerably longer than the Cenozoic.

Great Changes in Climate

The climatic changes which the earth has undergone have been great, but their causes are not well understood. There is little basis for the belief, formerly widespread, that the climate has on the whole been growing cooler. Cold periods seem to have alternated

HOW SCHOOL SLATES COME OUT OF THE SEA


Sea-bed of mud containing fossils
Ancient fire-formed rocks
Molten granite forced up from beneath
Mud changed by heat and pressure into slate
Mud hardened into rock
New layer being formed from worn-down rocks

This series of pictures illustrates the processes by which certain kinds of rock are made. In the first picture we see a bed of mud beneath the sea containing fossils and overlying the ancient fire-formed rocks. Ages later, perhaps, an immense fold of the earth's crust split and masses of molten rock welled up from below, flowing out over the surface. The heat and pressure of this molten mass turned the mud rock into slate. Then, thousands and thousands of years later, part of the granite was worn away by the flowing waters of a river, leaving the slate exposed. On the other side of the cliff you see the sea grinding more rock into mud, which may perhaps in the course of the ages be buried beneath another eruption of molten rock and harden into a new layer of slate. And so the Old Earth goes on changing its skin, shifting its waters, and working over its raw materials. The process may seem slow to us, but Nature has "all the time in the world" to do her work. Indeed, when you think that all recorded history only reaches back some 6,000 years, and that a million years, or more than a hundred times the span of all human history, is only a small period in geologic time, you can see how deliberately Nature proceeds about her tasks.

with warmer ones. There was local glaciation in the Paleozoic era, and extensive glaciation at the close of the Paleozoic. There was glaciation in the early Cenozoic era and very extensive glaciation later in that era; and there is some indication of cold periods at other times. On the other hand the lands of high latitudes enjoyed genial climates during some parts of the earth's history, even as late as the mid-Tertiary time.

Volcanic activity seems to have been greater at some periods than at others, but on the whole it seems to have been about as great, so far as now known, in late as in early stages of the earth's history, if the Archeozoic era be excepted.

The SCIENCE *that Measures* ANGLES, SURFACES, SOLIDS

NEXT to arithmetic no other branch of mathematics is so frequently used in our daily life as is geometry. When the farm or city lot and street on which you live were measured off and their boundaries determined, geometry was put to use. When architects planned and carpenters built your house and determined its lines and the steepness of the roof, they measured angles and lines and used geometry. When ships sail the sea to bring your food and clothing, their course and their cargo capacity have been based on geometrical knowledge. When you read in this book about the height of mountains, the boundaries of states and countries, or even examine the diagram of how a baseball diamond is laid out, you are learning of geometry and its applications.

GEOMETRY. As its Greek name indicates, geometry (from *geo*, "earth," and *metron*, "measure") had its origin long ago in earth measurement, not with the Greeks, but before them with the Babylonians and Egyptians. The lands of Egypt swept by the floods of the Nile had often to be resurveyed and measured to establish the vanished boundaries; and in 2000 B.C. the rope stretchers or surveyors of Egypt had their crude way of erecting a perpendicular and knew without formal demonstration that the square on the hypotenuse of a right triangle whose sides were 3, 4, 5, is equal to the sum of the squares on the other two sides. Even in building the pyramids some applications of geometry were necessary. The reasoning mind of the Greek made of all this a body of mathematical knowledge that had to do with the measurement of space. "Plane geometry" deals with circles, angles, squares, etc.; that is, it is two-dimensional; and "solid geometry" with cubes, spheres, and other three-dimensional bodies.

In the history of the Greek development of geometrical reasoning there are many names, but three stand out: Thales (640 B.C.–about 550 B.C.), one of the "seven wise men," is credited with originating the geometry of lines and angles and developing demonstrations of things which others took for granted. Pythagoras, his pupil (569 B.C.–about 500 B.C.), and the members of the great Pythagorean school studied mathematics in secret. Pythagoras is known to have proved that *the square on the hypotenuse of a right triangle is equal to the sum of the squares on the other two sides*, and this is known as the Pythagorean theorem. Euclid (about 300 B.C.) is the one name known when all others are forgotten in the history of geometry; his work has been the standard almost down to our own day.

The student who approaches the study of geometry must be thoroughly familiar with the measuring of lines—that is, from point to point—by practice with a rule, a compass, or squared paper ruled to inches and fractions of an inch. When he applies this to measuring a room it is with the object of applying another fundamental idea of geometry, that of ratio. When we say a room is ten yards long we mean that it is ten times as long as the standard unit, a yard; that is, the ratio of the yardstick to the length of the room is as 1 to 10. The ratio is the quotient of one number divided by another, $\frac{10}{1}$. Every measurement is the determination of a ratio of some sort and is often expressed as a fraction.

From these simple exercises we may proceed to some of the simpler geometrical constructions that arise out of the relation of lines to one another and to the definition of the basic terms used in geometry.

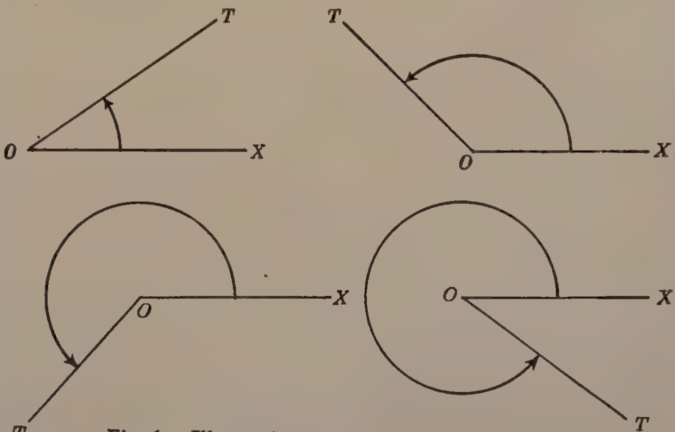


Fig. 1. Illustrating the Definition of an Angle

If a straight line, as OX in any of the drawings of Fig. 1, rotates in a plane about a fixed point, as O, in the direction indicated by the arrowheads (counterclockwise) until it reaches the position OT, it is said to turn through the angle XOT. Thus, an angle is the amount of turning made by a line rotating about a fixed point in a plane (flat surface). As the rotation continues, the size of the angle increases.

Vertex.—The fixed point O is called the vertex of the angle

Initial and Terminal Sides.—The line OX is called the initial side of the angle. The line OT is called the terminal side.

Symbol for Angle.—The symbol for "angle" is ∠; for "angles" it is ∠s. Thus, Angle XOT is written ∠ XOT.

Kinds of Angles.—If a line rotates about a fixed point in a plane so as to make one-fourth of a complete turn, the angle formed is called a "right angle" (rt. ∠). (*See* Fig. 2*a*.)

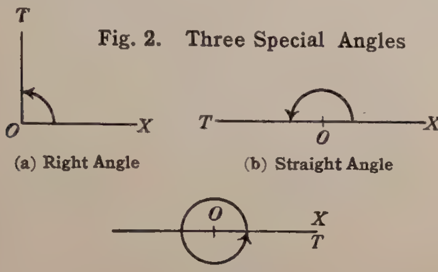


Fig. 2. Three Special Angles

(a) Right Angle

(b) Straight Angle

(c) Perigon

If the line makes one-half of a complete turn, the angle formed is called a "straight angle" (st. ∠). (*See* Fig. 2*b*.) If the line makes a complete turn, the angle formed is called a *perigon*. (*See* Fig. 2*c*.)

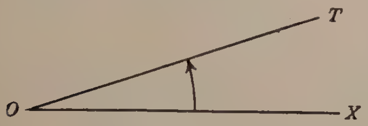


Fig. 3. Acute Angle

Angles are further classified upon the basis of their relation to the right angle, the straight angle, and the perigon. An angle less than a right angle is called an "acute angle" (Fig. 3). An angle which is greater than a right angle and is less than a straight angle is called an "obtuse angle" (Fig. 4). An angle greater than a straight angle and less than a perigon is called a "reflex angle" (Fig. 5).

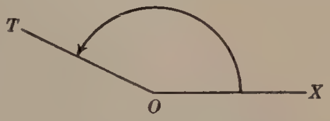


Fig. 4. Obtuse Angle

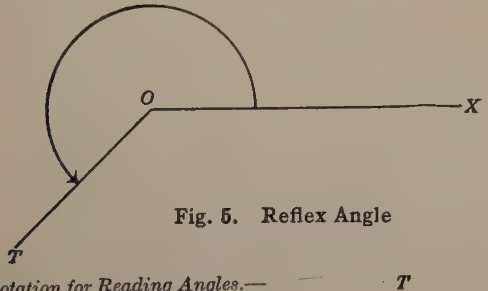


Fig. 5. Reflex Angle

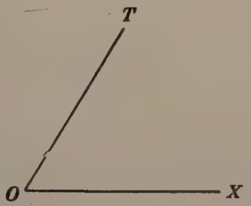


Fig. 6

Notation for Reading Angles.—There are three common methods by which one may denote angles: (1) Designate the angle formed by two lines OX and OT, as the "angle XOT" or the "angle TOX". Here the first and last letters denote points on the lines forming the angle, and the middle letter denotes the point of intersection (the vertex). In reading "angle XOT" we regard OX as the initial side and OT as the terminal side. (2) Denote the angle by a small letter placed as x in Fig. 7. In writing equations this method is the most convenient. (3) Denote the angle by the letter which is written at the point of intersection of the two sides of the angle, as "angle A." This last method is used only when there is no doubt as to what angle is meant.

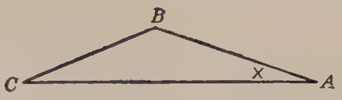


Fig. 7

If a line OX be taken as the initial side of an angle (*see* Fig. 8), and the line be rotated one complete turn (a perigon), any point, as P, on the line OX will trace a curved line which we call a "circle." Thus *a circle is a closed curve, all points of which lie in the same plane and are equally distant from a fixed point.*

The following terms are used in connection with the circle:

Center and Circumference.—The fixed point O is the "center" of the circle. The length of the curve (circle) is called the "circumference" (distance around) of the circle.

Radius and Diameter.—A line drawn from the center of a circle to any point on the circle is a "radius." Thus, OP is a radius of the circle. A line connecting two points on the circle and passing through the center of the circle is called a "diameter."

From the definition of "radius" given above it is clear that in a given circle or in equal circles one radius has the same length as any other. Thus we obtain the following important geometric relation: *Radii of the same circle or of equal circles are equal.* ("Radii" is the plural of "radius.")

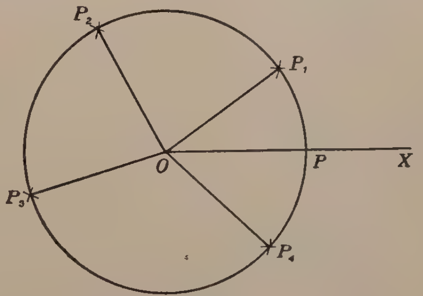


Fig. 8. The Circle

Ratios and Measurements. The circumference of a circle has a certain ratio to the diameter which is denoted by the Greek letter *pi* (π). The value of π is usually taken as 3.1416. The circumference of a circle, therefore, is expressed by the formula $2\pi r$, and the area by πr^2, in which r is the length of the radius.

Arc; to Intercept; Central Angle.—An "arc" is a part of a circle. If two radii are drawn from the center of the circle to two different points on the circle, they cut off an arc on the circle. The symbol for "arc" is ⌒. Thus, ⌒ AB is read "the arc AB." The angle formed at the center of the circle is said to "intercept" the arc. The angle at the center is called a "central angle."

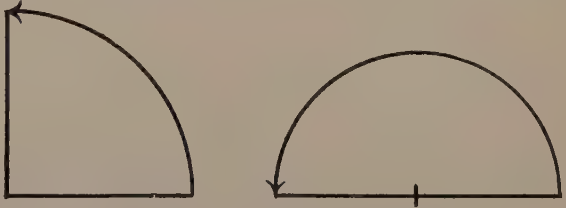


Fig. 9. Quadrant and Semicircle

Quadrant and Semicircle.—An arc equal to one-fourth of a circle is called a "quadrant." An arc equal to one-half of a circle is called a "semicircle" (Fig. 9).

How We Measure Angles.—In many instances the process of measuring angles is as important as that of measuring distances. An angle is measured when we find how many times it contains another angle selected as a unit of measure.

The "protractor" is an instrument devised for measuring and constructing angles. The protractor commonly consists of a semicircle divided into 180 equal parts. Each of these equal parts is called a degree of arc (1°). In the geography work in the grades, the unit for longitude and latitude was the degree of arc. In the measurement of angles we shall consider a unit corresponding to a unit of arc and called a "degree of angle."

If straight lines are drawn from each of these points of division on the semicircle to the center O, 180 equal angles are formed, each of which is a degree of angle (1°). Thus, the "unit" of angular measure is the "degree." A degree is divided into 60 equal parts, each of which is called a "minute" (1′).

Each minute is divided into 60 equal parts, each of which is called a "second" (1″). Of course the minute and the second graduations are not shown on the protractor.

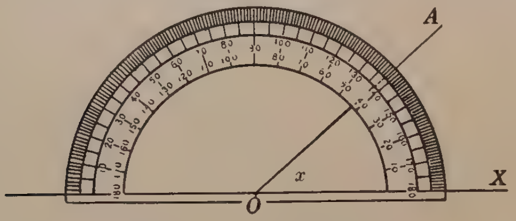


Fig. 10. Measuring Angles with a Protractor

How to Use the Protractor.—The protractor may be used to measure a given angle. Thus, to measure a given angle x place the protractor so that the center of the protractor (point O in Fig. 10) falls upon the vertex and makes the straight edge of the protractor coincide with (fall upon) the initial side of the given angle x. Now, observe where the terminal side of the given angle intersects (crosses) the rim of the protractor. Read the number of degrees in the angle from the scale on the protractor.

The protractor is also useful in constructing angles of a required size. For example, to construct an angle of 42° draw a straight line OX (Fig. 10) and place the straight edge of the protractor on the line OX so that the center rests at O. Count 42° from the point on OX where the curved edge touches OX and mark the point A. Connect A and O, and the angle thus formed will contain 42°.

Some Simple Problems in Construction

One of the important phases of geometry work is that of constructing perpendiculars, angles, parallel lines, and so on.

For example, let us consider the following problem:

At a given point on a given line to erect a perpendicular to that line by using ruler and compasses.

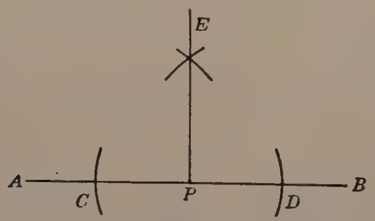


Fig. 11. How to Erect a Perpendicular

Construction: Let AB be the given line and P the given point (Fig. 11). With P as a center and with a convenient radius draw arcs intersecting AB at C and D.

With C and D as centers and with a radius greater than $\frac{1}{2}$ CD draw intersecting arcs. Call the point of intersection E, and draw EP. Then EP is the required perpendicular.

Another well-known construction problem is this:

At a given point on a given line to construct by means of a ruler and compasses an angle equal to a given angle.

Construction of an Angle.—Let DEF in Fig. 12 be the given angle and let P be the given point on the given line AB.

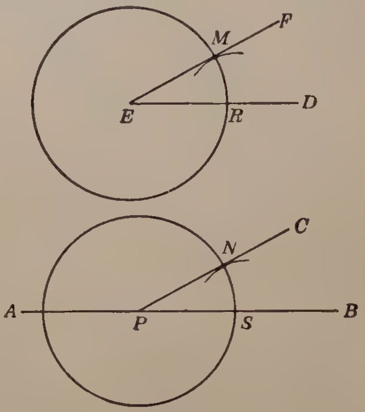


Fig. 12. Constructing an Angle Equal to a Given Angle

With E as a center and ER as a radius, draw a circle. With P as a center and with the same radius (ER) draw another circle. Place the sharp point of the compasses at R and cut an arc through M. With S as a center and the same radius cut an arc at N.

The $\angle BPC$ is the required angle.

Definitions.—If two lines form right angles with each other, they are said to be "perpendicular." The symbol for "perpendicular" is ⊥. The meaning of "parallel lines" is shown by Fig. 13. AB and CD in that figure have had the same amount of angular rotation from the initial line EF. Thus, they have the same direction and are said to be "parallel." The symbol for "parallel" is ∥. Thus, $AB \parallel CD$, is read "AB is parallel to CD."

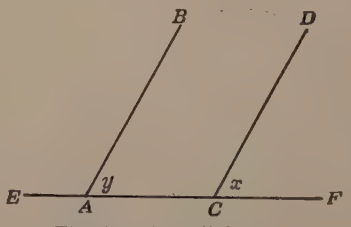


Fig. 13. Parallel Lines

Angles x and y in Fig. 13 are called "corresponding" angles. The line EF is called a "transversal." It is clear that the lines are parallel only when the corresponding angles are equal and that the corresponding angles are equal only when the lines are parallel.

Another important construction problem is that of drawing a line parallel to a given line. This we shall now explain.

Construction: Choose a point P outside the given line AB (Fig. 14). Draw a line through P so as to form a convenient angle x with AB. Call the point of intersection D. At P, using DP as initial line, construct an angle y equal to angle x (use method shown in Fig. 12). Then PR and AB are parallel because they have had the same amount of rotation from the initial line PD.

If one pair of parallel lines cross (intersect) another pair, the four-sided figure thus formed is called a "parallelogram"; that is, *a parallelogram is a quadrilateral whose opposite sides are parallel.*

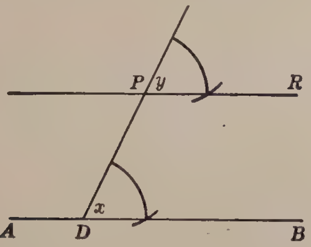


Fig. 14. How to draw Parallel Lines

If we remember the method used for constructing one line parallel to another, it will be easy to construct a parallelogram.

Construction: Draw a working line AB (Fig. 15). Draw AR making a convenient angle with AB. Through any point, as P, on AR draw a line PV parallel to AB. Through any point as M on AB draw a line MT parallel to AR. The figure $AMSP$ is a parallelogram, for its opposite sides are parallel.

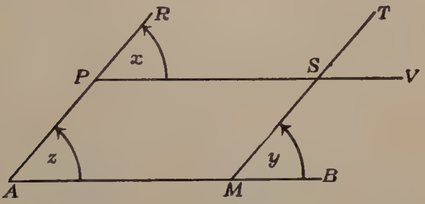


Fig. 15. How to construct a Parallelogram

If one of the interior angles of a parallelogram is a right angle, the figure is a *rectangle* (Fig. 16). Thus, *a rectangle is a parallelogram in which one interior angle is a right angle.* If all the sides of a rectangle are equal, the figure is called a *"square"* (Fig. 17).

Fig. 16

Fig. 17

If we determine the amount of area inclosed within a polygon, or several-sided figure, as in the triangle ABC in Fig. 18, we are *measuring the area* of the triangle. As in measuring length, the process is one of comparison. We compare the area of the given polygon with some standardized (defined and accepted) unit of area and determine how many units are contained in the polygon; that is, we determine the ratio between the area of the given polygon and a standard unit of area.

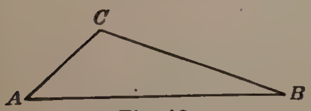


Fig. 18

The unit of area is a square, each of whose sides is a standard unit of length. Such a unit involves length and width. Thus, we may measure area and express the result in square feet, square inches, square meters, square centimeters, etc.

The drawings in Fig. 19 represent geometric solids. A solid is commonly thought of as an object that occupies a portion of space. It is separated from the surrounding space by its surface. In geometry we study only the form of the solid and its size. We are not interested in color, weight, etc. A solid differs from the figures we have been studying in that it does not lie altogether in a plane, but involves a third dimension.

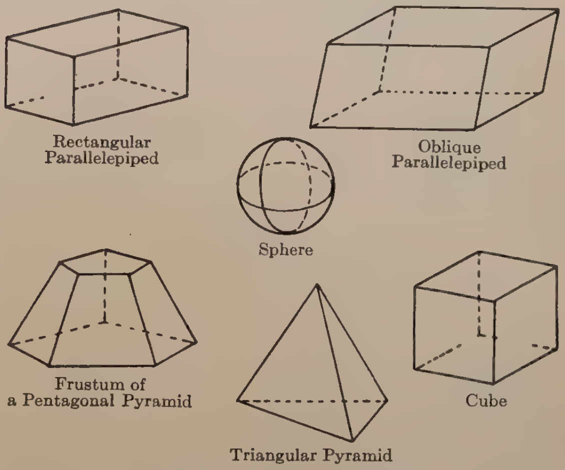


Fig. 19. Familiar Solids

Cube.—The cube has six faces all of which are squares. Two faces intersect in an edge.

Oblique Parallelepiped.—The faces of an oblique parallelepiped are all parallelograms.

Rectangular Parallelepiped.—The faces of a rectangular parallelepiped are all rectangles.

Measurement of Volume; Unit of Volume.—When we determine the amount of space inclosed within the surface of a solid we are measuring the "volume" of the solid. To measure the volume of a solid we compare the solid with a cube each of whose edges equals a unit of length. The volume is expressed numerically by the number of times the unit cube goes into the solid. The unit cube is called the *unit of volume.*

Essential Terms Defined

It is equally important that we should keep clearly in mind the definitions of certain geometrical terms.

Theorem.—In our geometry work we are concerned mostly with the proving of certain geometric relations. For example, we may prove that "The sum of the interior angles of a triangle is a straight angle." Such a statement of a geometric relation is called a "theorem." Thus a theorem is something to be proved.

Problem.—A "problem" in geometry is something to be done. Thus "To draw a perpendicular to a given point in a line" is a problem.

Proposition.—A "proposition" in geometry may be either a theorem or a problem.

Exercise.—A theorem or problem is often called an "exercise."

Corollary.—A truth which may grow out of or depend upon the truth of a proposition is called a "corollary."

In geometry we should know the following:

Outline of angle pairs formed by two lines cut by a transversal. When two lines are cut by a transversal, as in Fig. 20—

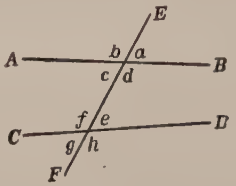


Fig. 20

angles c d, e, f, are called "interior" angles;

angles a, b, g, h, are called "exterior" angles;

the angles of the angle pairs $\left\{\begin{array}{l} a \text{ and } e \\ b \text{ and } f \\ d \text{ and } h \\ c \text{ and } g \end{array}\right\}$ are called "corresponding" angles;

the angles of the angle pairs $\left\{\begin{array}{l} d \text{ and } e \\ c \text{ and } f \end{array}\right\}$ are called "interior" angles on the *same side* of the transversal;

the angles of the angle pairs $\left\{\begin{array}{l} d \text{ and } f \\ c \text{ and } e \end{array}\right\}$ on *opposite* sides of the transversal are called "alternate-interior" angles;

the angles of the angle pairs $\left\{\begin{array}{l} b \text{ and } h \\ a \text{ and } g \end{array}\right\}$ on *opposite* sides of the transversal are called "alternate-exterior" angles.

The student of geometry should be careful to remember—

(a) that corresponding angles are equal;
(b) that alternate-interior angles are equal;
(c) that alternate-exterior angles are equal;
(d) that interior angles on the same side of the transversal are supplementary

only when the lines cut by the transversal are parallel.

Geometrical Methods of Proof

In geometry we have various methods of proving propositions. There is no one particular or invariable method of proof. The student of geometry should therefore become familiar with these methods. We shall explain each and illustrate some by examples.

The demonstration of a theorem consists of three parts: the part that is given (the *hypothesis*), the part that is to be proved (the *conclusion*), and the *proof*. And in proving a theorem one should give a reason for each step taken.

The briefest general directions for proving a proposition are:

(1) Be sure to read the proposition carefully.

(2) If the proposition is a theorem or exercise, draw a careful general figure, i.e., if the theorem concerns a triangle draw a triangle all of whose sides are unequal (scalene) and not one, all of whose sides are equal (equilateral) or one, two of whose sides are equal (isosceles).

(3) Write down clearly the hypothesis (the given part) and the conclusion (what is to be proved) and do this in terms of the letters in your figure.

(4) Try to work out the proof by falling back on anything you have previously learned that may apply, or draw some construction line or lines that may suggest the proof.

(5) Follow the outline given below for the form of your proof.

This makes it necessary to base each statement on (1) the hypothesis, (2) an axiom, (3) a definition, or (4) some other theorem which has previously been proved by geometrical methods.

The following proof will serve as an illustration: The theorem is: *The sum of the interior angles of a triangle is 180°* (Fig. 21).

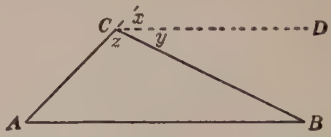


Fig. 21

Hypothesis: Triangle ABC.
Conclusion: $\angle A+\angle B+\angle C = 180°$.
Proof:

STATEMENTS	REASONS
Draw $CD \parallel AB$.	
Then $\angle x = \angle A$.	Because corresponding angles formed by two parallel lines cut by a transversal are equal.
And $\angle y = \angle B$.	Because alternate-interior angles formed by parallel lines cut by a transversal are equal.
But $\angle x+\angle y+\angle z = 180°$.	Because the sum of all the angles about a point in a plane on one side of a straight line is 180°.
$\therefore \angle A+\angle B+\angle C = 180°$.	By substituting $\angle A$ for $\angle x$, $\angle B$ for $\angle y$, and $\angle C$ for $\angle z$.

At the end of such a demonstration we generally write Q. E. D. (*Quod erat demonstrandum*, "which was to be demonstrated"); or if it is a proposition, Q. E. F. (*Quod erat faciendum*, "which was to be done").

METHOD OF PROOF BY SUPERPOSITION. The method of proof by superposition is the method used to show that certain figures have the same shape and same size (congruent figure). The symbol for "congruent" is $\cong$. It is the method always used to prove two triangles congruent when two sides and the included angle of one are equal respectively to two sides and the included angle of the other. The proof is as follows (Fig. 22):

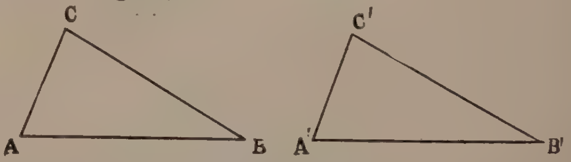


Fig. 22

Hypothesis: $\triangle ABC$ and $\triangle A'B'C'$ with $AC = A'C'$, $AB = A'B'$ and $\angle A = \angle A'$.
Conclusion: $\triangle ABC \cong \triangle A'B'C'$.
Proof:

Imagine the triangle ABC placed upon the triangle $A'B'C'$ so that angle A shall fit exactly upon its equal angle, A', AB falling upon $A'B'$ and AC upon $A'C'$.

Then since AB is given equal to $A'B'$, B will fall upon B' and since AC is given equal to $A'C'$, C will fall upon C'.

Then BC will fall along and coincide with $B'C'$, else there would be two different straight lines connecting the two points B and C, and this is evidently impossible because only one straight line can be drawn between two points.

Hence, the two triangles are congruent, i.e., they coincide, or fit.

Since ABC and $A'B'C'$ are any two triangles having two sides and the included angle of one equal to the corresponding parts of the other, the theorem is true.

METHOD OF PROOF BY CONGRUENT TRIANGLES. In order to prove that certain lines or angles are equal it is often expedient to show that the lines or angles are corresponding (homologous) parts of congruent triangles and are therefore equal.

For example, let us suppose we want to show that the base angles of an isosceles triangle are equal. To do this we would bisect the vertex angle of the isosceles triangle and then prove the two triangles thus formed congruent. The base angles of the original isosceles triangle would then be corresponding parts of the two little congruent triangles and therefore would be equal.

Indirect Method. The indirect method or *reductio ad absurdum* (reducing to an absurdity) method is one that is sometimes employed in geometry. The following proof will illustrate:

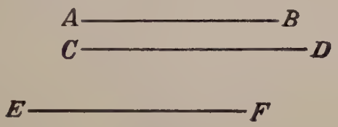


Fig. 23

Theorem: If each of two lines is parallel to a third line, they are parallel to each other (Fig. 23).

Given: AB and CD each parallel to EF, to prove $AB \parallel CD$.

Proof:

Statements	Reasons
Suppose AB is not parallel to CD and that they meet at some point P. Then, through P there would be two lines parallel to EF which is impossible.	Because through a point outside a given line only one line can be drawn parallel to the given line.
Therefore AB and CD lying in the same plane do not meet. Hence they are parallel.	Because when two lines lie in the same plane and do not meet, they are parallel.

Method of Analysis. The method of analysis is a very powerful and useful method in geometry, especially in construction work.

Let us take the following problem as an illustration: From a point outside a circle to draw a tangent to the circle.

Given: a circle whose center is O and a point P outside the circle (Fig. 24).

Required: to draw a line from P tangent to the circle.

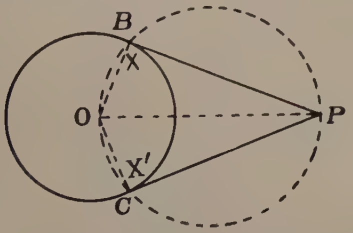


Fig. 24

Analysis: Imagine the two possible tangents drawn. Connect O and P. Draw OB and OC. Then if PB and PC are to be tangent to the circle, $\angle x$ and $\angle x'$ must be right angles, because a tangent to a circle is $\perp$ to a radius drawn to the point of contact. This suggests the construction, for we know that if a second circle is drawn on OP as a diameter, $\angle x$ and $\angle x'$ will be right angles, because all angles inscribed in a semicircle are right angles. (An angle is said to be "inscribed" when it is made between two lines, one of which runs from any point such as X on the dotted semicircle to one end of the diameter, O, while the other runs from the point X to the other end of the diameter, P. It can be proved, although the proof is not given here, that such an angle in a semicircle is always a right angle.)

Construction: Start with given circle and point P outside. Draw OP. Then on OP as a diameter construct a circle. Draw PB and PC and they are the required tangents.

Proof:

Statements	Reasons
Draw radii BO and CO. Then $\angle x$ and $\angle x'$ are each right angles.	Because any angle inscribed in a semicircle is a right angle.
Then BP and PC are tangent to the circle.	Because a line drawn perpendicular to a radius at its outer extremity is tangent to the circle.

Converse. The "converse" of a proposition is another proposition such that what is given in the first is to be proved in the second and what is to be proved in the first is given in the second.

For example, "An equiangular triangle is equilateral" is the converse of "an equilateral triangle is equiangular" (Fig. 25). Not all converse propositions are true. The one above is true, but consider the following: "All congruent triangles are similar." Conversely, "All similar triangles are congruent" is not true.

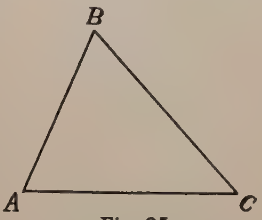


Fig. 25

Method of Proof by Elimination. The method of proving a proposition by eliminating all of the possibilities except one is sometimes used in geometry. For example, let us take the theorem, *In any triangle where two sides are unequal, the angles opposite these sides are unequal in the same order.*

Given: $\triangle ABC$ with $AB < AC$.
To prove: $\angle C < \angle B$.
Proof:

Statements	Reasons
There are three possibilities:	
(1) $\angle C = \angle B$	
(2) $\angle C > \angle B$	
(3) $\angle C < \angle B$	
$\angle C$ cannot equal $\angle B$.	Because if it were, AB would equal AC and this is not true.
$\angle C$ is not greater than $\angle B$.	Because if it were, then $AB > AC$ and this is not true.
Therefore $\angle C < \angle B$	By eliminating the other two possibilities.

Direct or Synthetic Method. The direct or synthetic method is the one commonly employed by textbook writers for setting down their proofs. It is logically ordered and more elegant than the analytic method. An example is given in Fig. 21 where the theorem *The sum of the interior angles of a triangle equals 180°* is proved. This method is the highly finished method and is the one which we use to write out our final proof in a most finished form.

The reader should endeavor to master all of the methods given here and consult the ordinary school textbooks for illustrative material.

More advanced branches of geometry than the plane and solid are "*analytical geometry*," a combination of algebra and geometry which can be studied after one has mastered elementary algebra and geometry; and "*projective geometry*" which treats not so much the figures but their projections. The subject, however, is extremely interesting and helpful and throws much light on the elementary field. *Non-Euclidean* geometry builds up a system based on other views of the properties of parallel lines than that in the Euclidean. It usually rejects the Euclidean assumption that parallel lines never meet, and is complex.

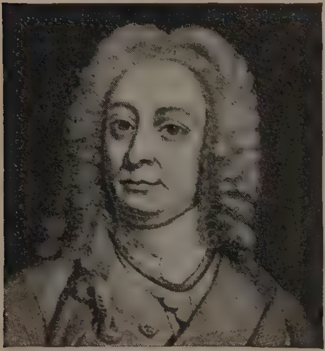
ENGLAND'S GEORGES *and the House of Hanover*

Rise of Cabinet Government under the First Two Georges—Injuries Wrought by the Stupid Stubbornness of George III—Change of the Family Name by George V

GEORGE, KINGS OF ENGLAND. It was the marriage of the daughter of James I of England to Frederick, Count Palatine of the Rhine (*see* Thirty Years' War), that eventually brought to the British throne the Hanoverian or Guelf (Guelph) line of rulers, five of whom have borne the name of George.

GEORGE I
First of the Hanoverians

GEORGE I, a grandchild of this marriage, was Elector of Hanover, a north German state, and succeeded to the British throne as the nearest Protestant heir on the death of Queen Anne. He ruled Great Britain, in addition to his German state, from 1714 to 1727, dividing his time between the two countries. He was a silent awkward man, 55 years of age when he came to the English throne, and spoke only German. Because of this and of his paramount interest in his German lands, he left almost everything to his English ministers, in whom he had implicit confidence. He gradually ceased even to attend cabinet meetings. Sir Robert Walpole, the head of the cabinet and the first real prime minister, became in effect the actual ruler of Great Britain so long as he was supported by Parliament (*see* Cabinet). Adherents of the Jacobite (exiled Stuart) line were easily put down in 1715.


GEORGE II
Under Him Cabinet Government Prevailed.

George's wife, Sophia Dorothea, was divorced for misconduct in 1694, and kept in seclusion until her death in 1726. With this ruler began the habit of bad relations between the king and his heir, the Prince of Wales, which lasted through the 18th century.

GEORGE II, 1727–1760, the son of George I, was, like his father, more interested in Hanover than in England. He was a vain pompous little man, fond of show but extremely economical. One of his favorite diversions, it is said, was counting his money like the king in the nursery rhyme. Although George II spoke English brokenly he too left the management of affairs first to Walpole and later to the elder William Pitt, under whom the country gained brilliant victories in the French and Indian War (*see* Chatham, William Pitt, Earl of). The Jacobite rising of 1745 was a much more serious affair than in 1714, but it too proved unsuccessful (*see* Pretender). George's queen, Caroline of Anspach, was a woman of remarkable ability and proved a tower of strength both to her weak husband and to his English ministers.

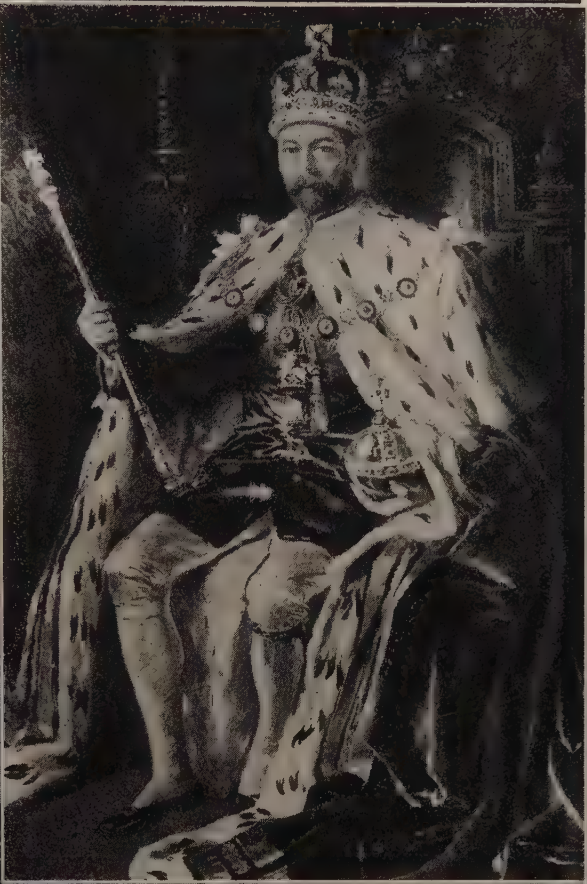
GEORGE III, who reigned from 1760 to 1820, was the grandson of George II, born in 1738. His father, Frederick, Prince of Wales, had been on the worst possible terms with George II, but had died in 1751. George III was the first of the Hanoverian rulers who was born and educated in Britain. From his teachers, especially the Scottish Earl of Bute, and from his mother—who continually urged him, "George, be king"—George III drew the idea of restoring the king of England to his old position of power.

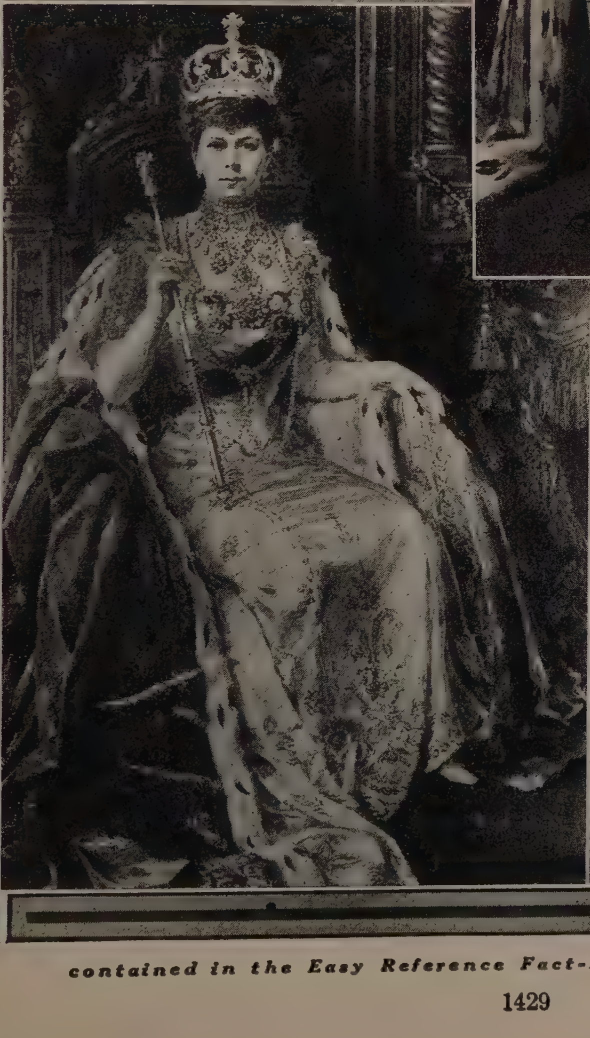
GEORGE III
He Caused the Revolt of the American Colonies.

But this could have been done only by a strong king, and George III had only average ability. He had, however, more than average obstinacy, and he refused to give up his course until he lost for England her 13 American colonies and "inflicted more profound and enduring injuries upon his country than any other modern English king." Lecky, the British historian

GEORGE V AND QUEEN MARY OF ENGLAND

This is George V, "by the Grace of God of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas King, Defender of the Faith, Emperor of India." He is shown here in the royal robes and crown of the British Empire, with scepter and orb. Between the state occasions on which this royal regalia is used, it is carefully preserved in the Tower of London.





Queen Mary, formerly Princess Victoria Mary, daughter of Francis, Duke of Teck. The coronation robes in which she is shown were the pride of Great Britain, for every article was the product of British workmanship. The crown, which was made for the occasion, bears the famous Kohinoor diamond, seen in the picture as a dark spot in the center of the crown.

just quoted, further says that George III spent his long reign—longer than that of any other British ruler except Queen Victoria—in "obstinately resisting measures which are now almost universally admitted to have been good, and in supporting measures which are as universally admitted to have been bad." He did not dare to attempt to rule without Parliament as the Stuarts had done, but he sought to corrupt it—by gifts of offices, titles, contracts, and even money—and so built up a party known as "the king's friends." With the triumph of the colonists at Yorktown and the fall of Lord North, the king's figure-head minister, George's attempt at political reaction was ended. First the Whigs and then—after the outbreak of the French Revolution—William Pitt the Younger controlled the government.

George III had long been subject to fits of insanity, and during the last ten years of his reign he was a blind and insane wreck, an object of pity to all. His personal life, as a son, father, and husband, was exemplary.

A Contemptible King

George IV, 1820–1830, the son of George III (born in 1762), was a dissolute and incompetent ruler, though he prided himself on being "the first gentleman of Europe." For nine years before his accession he had been Prince Regent owing to his father's insanity. More wicked kings have reigned over England but none who were more contemptible. His treatment of his young queen was abominable, and when he attempted to divorce her a wave of indignation swept over the land. The government, both in Great Britain and Hanover, was in the hands of his ministers. His brother, William IV, succeeded him in 1830, the only child of George IV (a daughter) having died some time previously. William IV in turn was succeeded by his niece Victoria, daughter of his younger brother, the Duke of Kent (*see* Victoria).

A Wise and Careful Monarch

George V (born 1865, ruled 1910–   ) was the grandson of Queen Victoria, and son of Edward VII. As a young man he was trained for the sea and had risen to be a commander in the British navy when the death of his elder brother opened to him, at the age of 27, the eventual succession to the throne. As king he sought to maintain the wise policies of constitutional rule followed by his father and grandmother. Like his father he had gained personal knowledge of the outlying posts of the empire by a tour of the colonies before he became king. During the World War he crossed over to France several times and was the first British king since 1743 to join his armies in the field. Owing to the dislike of all things German created by the war, George V announced that henceforth his family would be known as the house of Windsor, from the royal castle of that name in England. The connection of the English royal house with Hanover had ceased in 1837, when a woman, Queen Victoria, came to the British throne.

George, Saint. The most popular of the many legends of St. George, the patron saint of England, is that which tells how he once slew a monstrous dragon, against which an armed force had been of no avail (*see* Dragon). This story, the scene of which is laid at Lydda, an ancient town in Palestine, is of course, pure myth, like most similar legends of heroes in other lands. St. George is said to have been a soldier born of noble Christian parents, in Cappadocia, a Roman province of Asia Minor. He is reported to have suffered martyrdom at the hands of the pagan emperor Diocletian, in the year 303. Many miracles were ascribed to him. He was made the patron saint of England in the reign of Edward III.

GEORGE JUNIOR REPUBLIC. Near Freeville, N.Y., is a model village whose population is made up entirely of boys and girls from 12 to 18 years old, supervised by a few older persons. The young people enjoy complete self-government, with a constitution, a congress, courts of law, a police force, and a jail of their own. They carry on their own trades and industries, administer all their business affairs, elect their own officers, and make their own laws, subject only to the veto of the superintendent, William R. George, who founded the republic in 1895. It started as a summer colony for poor and wayward children, but soon became a permanent institution where the "citizens" remain for several years. The object is to teach self-reliance, regard for the rights of others, and an appreciation of the many duties and difficulties to be encountered in later life.

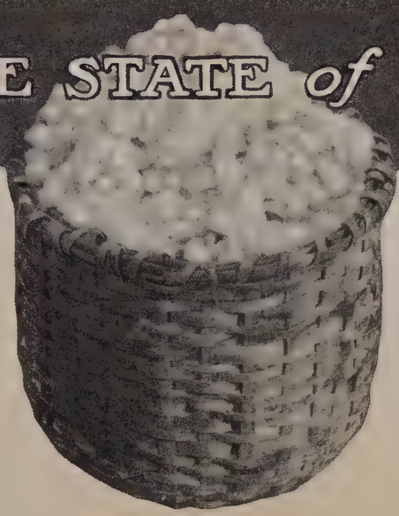
Opportunities are given to every boy and girl to earn money. "Nothing without labor" is the motto of the community, and those who, through laziness or extravagance, find themselves penniless must sleep in the jail and work the next day for the use of the cell and for their meals. The citizens live in group cottages, each under the care of a house-mother. Children under 15 are in charge of a citizen guardian.

All under 16 must go to school. After that age they may continue the higher courses, which prepare them for college, or they may enter business. The boys take up carpentry, farming, plumbing, printing, baking, and other useful trades. The girls are taught sewing, cooking, laundry work, and other branches of domestic science.

The village, which is situated in a 240-acre tract of land, has its school-house, its bank, general store, library, government building, restaurants, and many workshops. Model gardens and small patches of farm lands on the outskirts provide agricultural training. Children from all parts of the United States are admitted, provided they are healthy and in need of the reforming or uplifting influence given by the republic. The religious life is conducted on a non-sectarian basis.

Similar organizations have been founded in a number of other places. In 1908 the National Association of Junior Republics was formed, to coördinate the existing institutions and promote new ones.

The EMPIRE STATE *of the* SOUTH



GEORGIA, STATE OF. Greatest in area of all the states east of the Mississippi, with a surface nearly as large as all New England, Georgia stands in the front rank among the states of the Union as regards the value and variety of its products. More than two-thirds of its area is covered with forests; yet it ranks among the foremost states in the value of its agricultural products. Cereals of the temperate zone as well as fruits of the semi-tropics are produced within its borders. It is surpassed only by Texas in the value of its cotton, and corn is a staple crop. Rich quarries add to its wealth, and magnificent water-power helps to convert its cotton and lumber into manufactured articles. In the total value of its products the "Empire State of the South," as it is popularly called, holds third place among the southern states, ranking next after Texas and North Carolina, while in area and population it is surpassed only by Texas.

Extent.—North to south, 320 miles; east to west, 253 miles. Area, 59,265 square miles. Population (1920 census), 2,895,832.

Physical Features.—Blue Ridge, Cohutta, Lookout, and Sand Ranges in the northern section (highest point, Brasstown Bald Mt., 4,768 feet); Piedmont region, 300 to 1,500 feet; coastal plain fringed with marshes and islands along the Atlantic coast. Principal rivers, Savannah, Ogeechee, Altamaha, St. Marys, Flint, Chattahoochee; Okefinokee Swamp.

Products.—Cotton, corn, sweet potatoes, hay, oats, sugar cane, peanuts, fruit, and rice; cotton goods, hosiery and knit goods, lumber and timber products, turpentine and rosin, cotton-seed oil and cake, fertilizers; marble and granite, clay products.

Cities.—Atlanta (capital, 200,000), Savannah (85,000), Macon (55,000), Augusta (55,000), Columbus (32,000).

The Lay of the Land

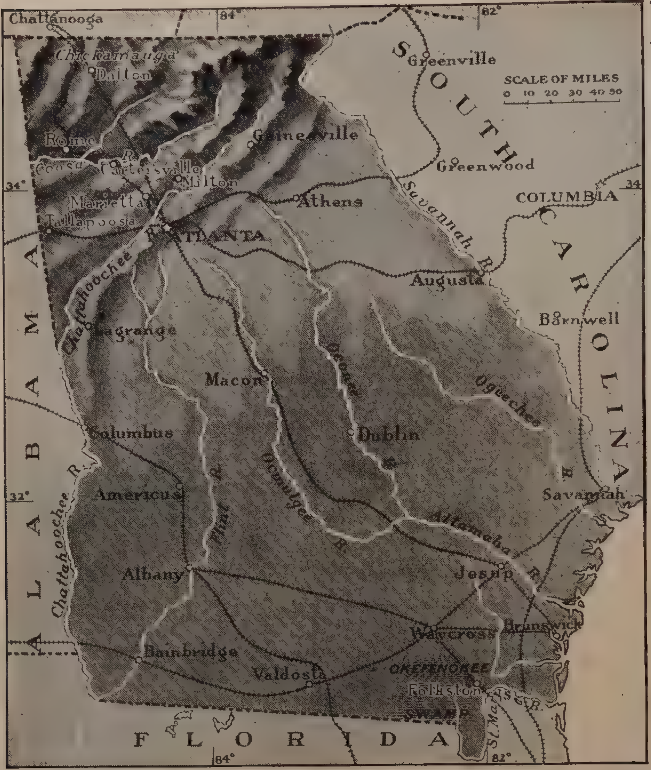
Sloping gradually from the north to the southeast, Georgia is divided naturally into three sections—the northern Appalachian region, the central Piedmont plateau, and the low coastal plain. The first and smallest of these, the "roof garden" of the state, abounds in impressive scenes—waterfalls, cascades, and winding streams, with backgrounds of mountain or hill covered with beautiful forests. Interesting caves are found in many places, some—for example, Hardin's cave near Kingston—of great extent with far-reaching galleries. The northern section is noted also for its charming valleys, which in season are covered with abundant crops of varied cereals, grasses, and fruits.

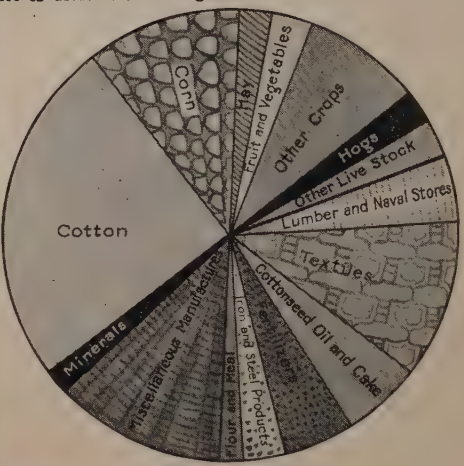
To the south the Appalachian region gradually gives away to the Piedmont plateau, a level rolling country with only here and there a conspicuous isolated hill. Stone Mountain, near Atlanta, a massive dome of granite over a mile in diameter and 700 feet high, is one of the impressive sights of the state. In this middle section is the densest population, since it has not only the largest proportion of land under cultivation—growing great quantities of cotton, as well as other crops—but the most important cities as well. Dividing it from the coastal plain region is the "fall line," so called because most of the rivers which cross it have rapids at this point. Along this line cities have sprung up on account of the water-power, and also because the fall line marks in most cases the head of river navigation. By drawing a line through Columbus, Macon, Milledgeville, and Augusta, the fall line may be located.

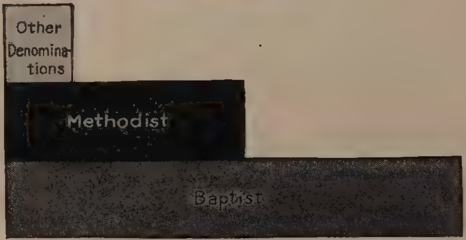
South of the Piedmont region lies the flat coastal plain, covering more than one-half the state, and abounding in large navigable rivers. This section is the region of the sandy "pine barrens," the chief home of the famous Georgia pine; but it is an important agricultural area as well, for in wide belts the forest lands, when cleared and fertilized with the native marls and swamp muck, become excellent farm lands. In the southeast, extending into Florida, is the beautiful wilderness known as Okefinokee Swamp, covering about 700 square miles. Here are found quantities of long-leaf pine, cypress, and saw palmetto, as well as black gum, tupelo gum, and some live oak. The region has long been a favorite resort with sportsmen because of its variety of birds, fish, and game.

Georgia's greatest wealth-producing factor is cotton, which grows in almost every section of the state, from the valleys in the north to the numerous islands along the coast, where more of the famous sea-island cotton is produced than in any other state. Corn, which ranks next to cotton in importance, is also grown practically everywhere. Fruit abounds in all sections, and includes almost every kind grown in the United States; best known, however, are the peaches, watermelons, and cantelopes, which are grown for the northern markets. Sugar cane, used largely in the manufacture of syrup, is grown over the middle and southern sections. The pecan tree thrives near the coast, and peanuts ("goobers") form a very important crop in many counties. Oats and hay are grown in increasing quantities, and grazing is a profitable industry. Rice, long one of Georgia's principal products, is losing importance.

THE STATE THAT IS FAMOUS FOR COTTON, CORN, AND PINE




The circle shows how the products of its fields and forests enrich the state of Georgia, and below we see how the state is divided into religious denominations.



Georgia's vast forests, which still cover approximately 40,000 square miles, rank next after corn as a source of wealth. No tree in the temperate zone serves better the wants of mankind than does the Georgia pine, which can be utilized from its roots to its needle-like leaves. Its long slender trunk is good for furniture and building; the highest grades of charcoal are made from its bark; both roots and bark are used for lampblack; from the sawdust is distilled wood alcohol and creosote; the sap supplies turpentine and rosin; and the seed is used as food for hogs. The hardwoods found in the northern part of the state are also very valuable.

Georgia is not rich in mineral products, although some gold is mined, and coal, iron, and bauxite (aluminum ore) are found in commercial quantities. The state is noted for the excellent quality of its marble, which is exceptionally pure and white. Granite is found in inexhaustible quantities, and clay for brick and tile exists throughout the state.

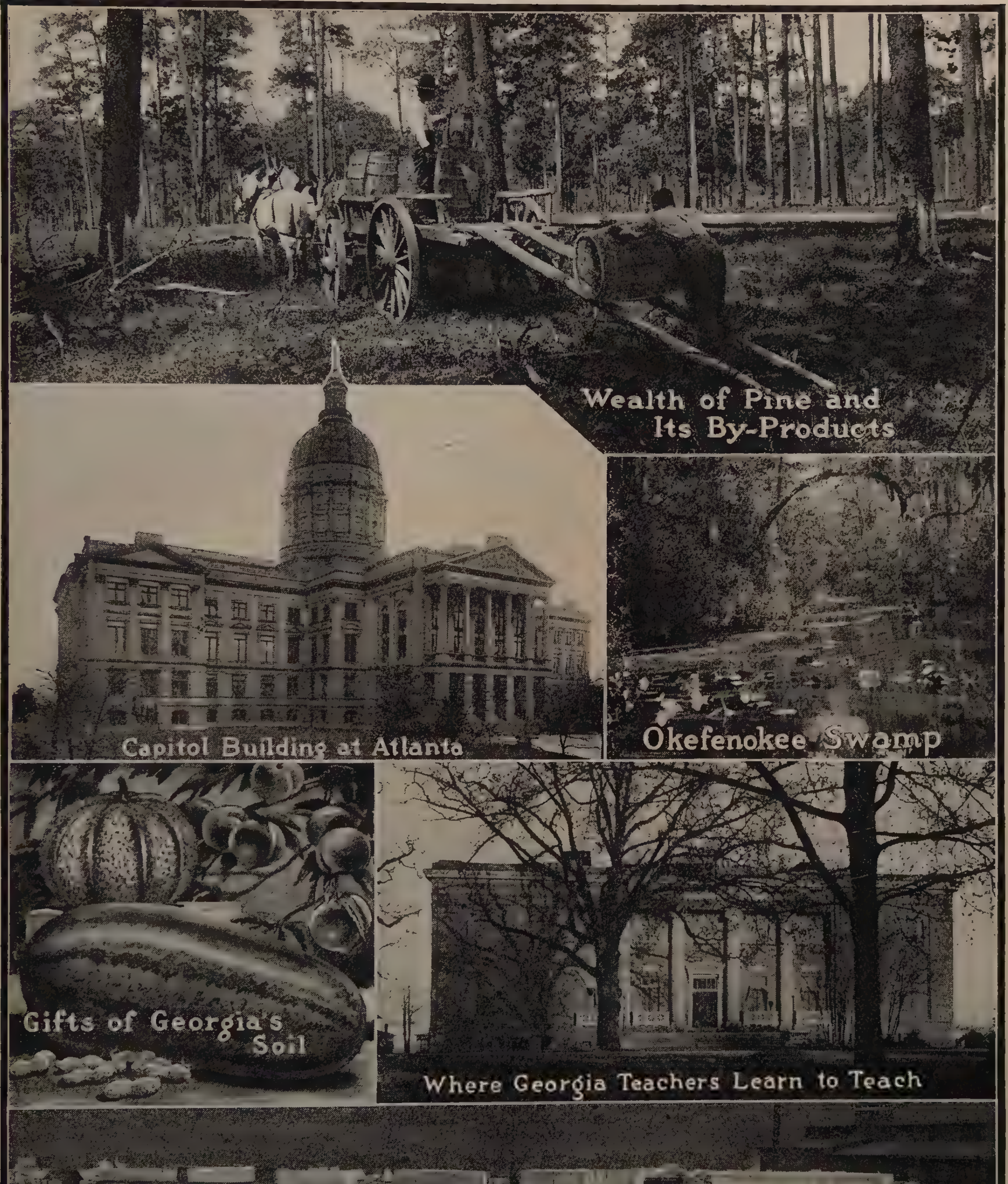
As is to be expected, cotton and lumber form the basis of Georgia's manufacturing industry. Every important city has its textile and cotton-oil mills, and Georgia ranks second among the states in the manufacture of naval stores (rosin, tar, turpentine, etc.). In addition to many furniture factories and lumber mills, there are flour and grist mills, foundries, and manufactories of brick, tile, and pottery.

Only 20 per cent of Georgia's population is urban, but it nevertheless contains some of the most important cities of the South. Savannah, near the mouth of the Savannah River, is the greatest cotton port on the Atlantic coast, and one of the most important commercial cities of the South (*see* Savannah). About 200 miles farther up the river is Augusta, a popular winter resort, which is known as the "Lowell of the South" because it is the largest cotton-manufacturing center of the Southern states. Macon, in the center of the state, is remembered as the home of Sidney Lanier, one of the most lyrical of Southern poets; and also as the seat of Wesleyan College, one of the first of women's colleges. Excellent water-power is furnished for its cotton and knitting mills by a great dam on the Ocmulgee River. The capital and largest city is Atlanta, in the north-central part of the state (*see* Atlanta).

One-half of the total population is made up of negroes, about one-tenth of all the negroes in the country—more than in any other state—residing in Georgia. There is an excellent public school system, but the percentage of illiteracy, especially among the negroes, is high. There are also numerous colleges and industrial schools, some of which are for negroes. The University of Georgia at Athens, the Georgia School of Technology at Atlanta, and the North Georgia Agricultural College at Dahlonega are among the most important higher institutions.

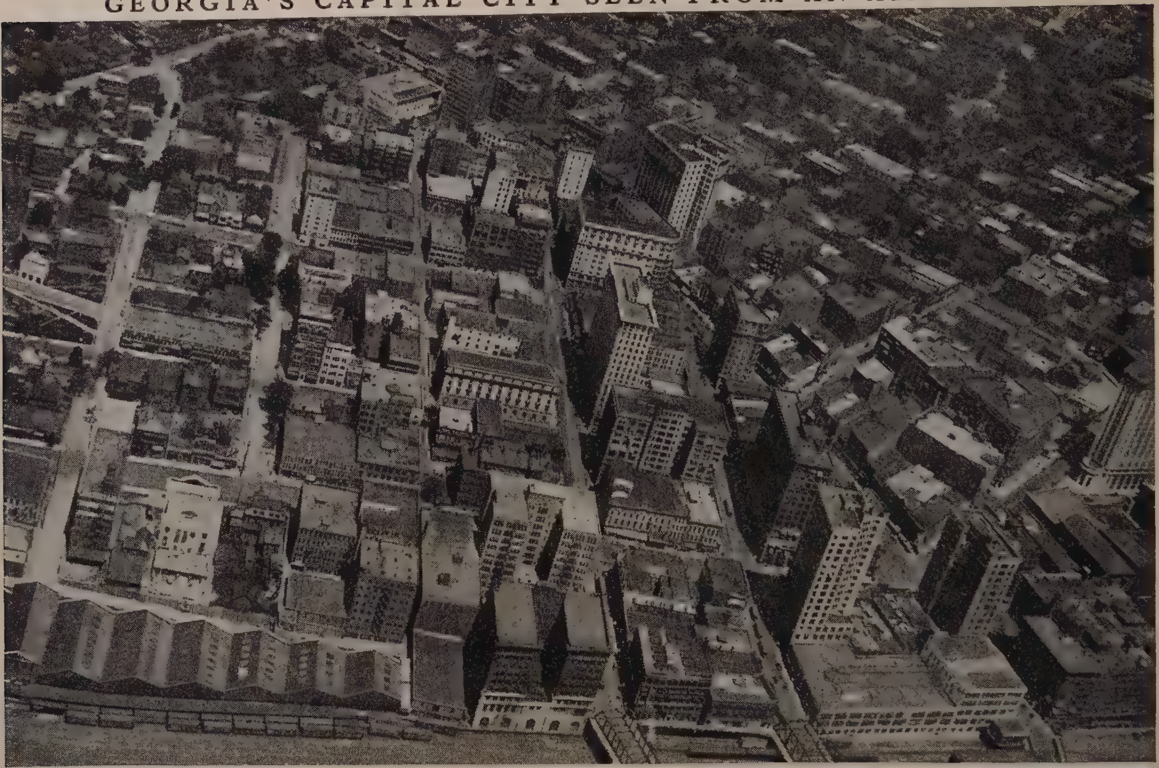
As early as 1540 De Soto and his followers crossed Georgia in their search of gold, but it was more than two centuries before the first European settlement

GLIMPSES INTO THE HEART OF GEORGIA


Wealth of Pine and Its By-Products
Capitol Building at Atlanta
Okefenokee Swamp
Gifts of Georgia's Soil
Where Georgia Teachers Learn to Teach
Out of the Marble Quarries

Georgia is rich in natural products. Her pine forests are famous the world over, and her rich soil produces typical warm climate crops and such fruits as peaches and melons in abundance, to say nothing of the valuable annual yield of peanuts. Fine grades of marble come from her quarries, and she has large cotton and lumber mills. The scenery of the state is marked by rich vegetation, and her swamp lands teem with varied animal life. Georgia is proud too of the educational advantages afforded by her many institutions of learning. At their head is the State University at Athens, one of whose buildings is shown above.

GEORGIA'S CAPITAL CITY SEEN FROM AN AIRPLANE



This interesting view was taken by an airman flying westward over the principal business district in Atlanta. In the lower left-hand corner is the railway station, while Peachtree Street, the best-known "down-town" thoroughfare, starts in the lower right-hand corner and runs toward the tall building in the upper center.

was made, Georgia being the last settled of the original 13 British colonies. In 1732 a number of benevolent gentlemen in London obtained from the king a charter to found a colony for the poor of Great Britain and the persecuted Protestants of Europe. They called the colony "Georgia" in honor of George II. In 1733 James Oglethorpe, who had been selected as governor, sailed up the Savannah River with 116 immigrants and founded the city of Savannah, which he named after the river. During the ten years of Oglethorpe's administration the colony prospered greatly, and many settlers were attracted to it, including, in 1734, a band of Lutheran refugees from Germany, the "Salzburgers." Slavery was at first prohibited, but allowed after 1749.

A Battleground in the Revolution

Some of the most important battles of the Revolution were fought on Georgia's soil. Under the Federal Constitution the state increased steadily in wealth and population, many settlers coming in from the states farther north. In 1802 Georgia sold to the Federal government all of its lands westward from the Chattahoochee to the Mississippi, and the United States government promised to settle peaceably all Indian claims to territory in the state of Georgia. In fulfillment of this promise it finally transferred all of the troublesome Creeks and Cherokee Indians to their allotted lands in Indian Territory.

In 1861 Georgia seceded from the Union, and it bore a prominent part in the Civil War which followed. Chickamauga and other great battles were fought within its borders, and Sherman's march "from Atlanta to the sea" scattered destruction along its path. Reconstruction was begun immediately after the declaration of peace, and Georgia gradually regained its important position of pre-war days. In restoring good feeling between the North and South, one of the most prominent workers was Henry W. Grady, a silver-tongued orator and journalist of Atlanta, who labored untiringly for the advancement of the "New South."

GEORGIA. A democratic republic of Asia, south of the Caucasus Mountains and bordering on the Black Sea to the west. It was formerly a part of Transcaucasian Russia, but declared its independence (May 26, 1918) following the Russian Revolution. Tiflis is the capital and Batum the chief port. The people are a handsome athletic race of ancient white stock (*see* Caucasus Mountains). In spite of long pressure from surrounding Mohammedans, they are devoted members of the Greek Catholic church. From the time of Alexander the Great to the Conquest of Russia (1801) Georgia had its independent line of princes. Cereals, cotton, fruit, and wine are the chief products of the country. Area, about 35,000 square miles (about the size of Indiana); population, 2,700,000.

GERANIUM. Botanists tell us that the red, white, or pink "geranium" plants whose spicy fragrance scents summer gardens and window-sills really are not geraniums at all; they are pelargoniums. But real geraniums are found all over our woods and thickets—graceful wild flowers that often look like wild roses, swinging their five-petaled heads on long hairy stems. We call them crane's-bills or wild geraniums. The spotted crane's-bill is about two feet high and each of its numerous branches bears two light purple flowers about an inch across. Its bitter root-stock is used as a medicine. Another common species is Herb Robert, a plant with dainty little light purple flowers streaked with red, found in damp shady woods and ravines.

The house plants we call "geraniums"—the pelargoniums—belong to the same family but differ greatly from the true geranium in appearance. They are much prized for their large, irregular, variously colored flowers and their leaves that vary so in shape, texture, and marking. Geranium oil, a substitute for attar of roses, is distilled from certain species growing in Algeria and in Cape of Good Hope, where most of the plants of this genus have come from.

Both the geranium and the pelargonium belong to the plant family *Geraniaceae*. The geraniums number about 160 species, and are dispersed throughout the temperate regions of the world. The pelargoniums—the commonest of whose 200 species are the cultivated ivy geranium (*Pelargonium peltatum*), the rose geranium (*Pelargonium graveolens*), and the nutmeg geranium (*Pelargonium odoratissimum*)—are perennial herbs or shrubs.

The Language of LUTHER, GOETHE, *and* SCHILLER

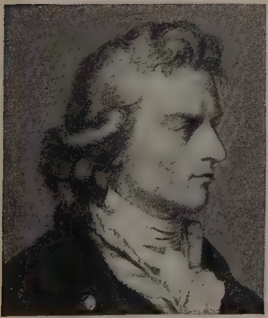
GERMAN LANGUAGE AND LITERATURE. Rough and guttural though German may be, it somehow lends itself naturally to poetry. While German prose is often inclined to do anything but come "trippingly on the tongue," the best German verses are true music. They are alive with sincerity, they speak directly and unmistakably to the human soul, they strike deep to the very elements of life. And much of this wild-flower charm is apparently due to the vital quality of the language itself.

MARTIN LUTHER

His Translation of the Bible Fixed the Standard of German Prose.

When we first meet with the Germans, or Teutons, about the beginning of the Christian era, they form three distinct groups with corresponding tongues—the East Germanic or Gothic, the North Germanic or Scandinavian, and the West Germanic, from which originated primitive German, English, Dutch, etc. This primitive German continued to split up into dialects as the tribes settled permanently in various districts; but the chief dialects were the High German of the mountainous region of central and southern Germany, and the Low German of the lowland country in the north. High German won out over the dialect of the plains, and it is High German which is the official and literary language of Germany today.

SCHILLER



Lyric Poet, Dramatist, and Friend of Freedom.

German is really a simple and direct language, although it may present a formidable appearance to the beginner. The first difficulty lies in the old "Gothic" characters, in which most German books are printed. This alphabet is simply a variation of the Roman, and any word written in the former can be reproduced letter for letter in the latter script. Next, the beginner is struck by the enormous length of many German words. But these are due to the ease with which compounds are formed, and when such words are split up into their several parts, they prove not only easy to understand but have a remarkable gift of expression. Thus, the word "Volksschullehrerseminar" looks almost hopeless with its 23 letters, until we divide it thus: "Volks-schul-lehrer-seminar." Then we discover by translating it bit by bit that it means "public-school-teachers' seminary," or, in other words, a training college for elementary teachers.

The formation of such compounds gives an exactness of meaning which is often lost in looser English phrases. And when we add to this the practice, so common in German syntax, of reserving the verb or part of the verb for the end of the sentence, thus holding the reader's attention suspended until the *whole* of the thought has been expressed, we realize why German is so valuable a language for scientific descriptions of all sorts.

HEINE

A Sparkling Poet and Master of Wit and Irony.

The Roman historian Tacitus, writing in the year 98 A.D., tells us that already the German barbarians of that period had a poetry of their own. The warriors would advance to battle, he says, singing hymns to Thor, the god of thunder, their shields held before their mouths to clang out a greater volume of sound. And ever since, no matter what refinements or complexities have developed in German literature, there still remains in it this martial clang of shields, the distant thunder of tribal religion, a hard sonorous music, larger and louder than life. Even the sweetest of their folksongs have something at once vigorous and dark running through them.

For a long time this ancient poetry remained unwritten, or, if fragments of it were carved now and then in the old Runic alphabet on wooden staffs and metal tablets, it was soon lost, or at best remained but fragments.

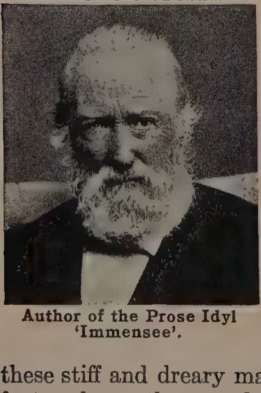
Not until the 4th century do we find a book written in a Teutonic tongue, and by that time it treated not of the god Thor, but of Christianity. This book was a translation of the Bible made by Ulfilas, the native missionary to the Goths. In order to make his translation, Ulfilas was obliged first to invent the Gothic alphabet, combining Greek, Latin, and Runic letters to do so. The tongue of those ancient Goths, as we here find it, possessed much of the rolling beauty and expressive roughness of the German language today.

SCHOPENHAUER

A Philosopher who Preached a Doctrine of Pessimism.

But though Ulfilas began the conversion of the Germans to the Christian religion, their poets continued for centuries to sing of the old gods, of Brunhild and Gudrun, and the flying Valkyrs, as well as of mighty historic figures such as Attila (Etzel) the Hun. The 'Nibelungenlied' of the 13th century is the most famous of these wild old dreams of gods and heroes, and it has been the source of much modern German literature, like a great changeless lake of rugged beauty from which trickle delicate but more transient streams.

THEODOR STORM



Author of the Prose Idyl 'Immensee'.

A lighter note, however, tinkled along beside these resounding epics, the music of the "minnesongs," or love lyrics of knighthood. These dwindled out finally in the wholly mechanical "mastersongs," composed by rule and turned out like factory goods. Yet the same period (15th and 16th centuries) in which these stiff and dreary mastersongs were being manufactured was the very heydey of the delightful German "folksongs"—simple abiding music, by poets whose names are unknown.

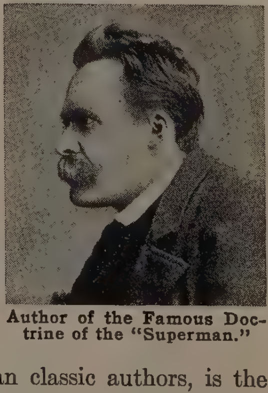
About this time also German prose began to develop and also German drama, chiefly in the hands of the clergy. Church plays grew into great and solemn spectacles, of which the celebrated Passion Play of Oberammergau is an impressive survival. And when the Reformation came in the church, religion found even more beautiful expression in the fine old hymns of Martin Luther. But it was Luther's translation of the Bible which had the most important effect. This did for the German language what the works of Dante, Petrarch, and Boccaccio did for Italian, or what the King James Bible did for English. It fixed the standard of the language in the midst of a confusion of dialects. Modern German dates largely from Luther's works.

As the years went on, religious disputes became angrier; the Thirty Years' War (1618–1648) broke out, and the light of literature vanished in its horrors. National feeling decayed, and a weak and war-worn generation mimicked French thought and customs in almost every field. Great literature does not come by imitation.

Therefore it was not until the time of Frederick the Great that German literature flourished again. To be sure, this king of Prussia was contemptuous enough of the national literature; he preferred to copy the French style of writing and honored French authors, notably Voltaire, far more than he did the oncoming German writers. But Frederick raised Germany from the dust, and gave to German genius a sense of pride and independence which permitted it to break with French and English models—in spite of Frederick himself—and create beauty out of its own substance. Thus Frederick's reign (1748–1786) ushered in the "great century of German literature."

In this century glow the names of Klopstock, Lessing, Wieland, Goethe, Schiller, Richter, the brothers Grimm, Fouqué, von Kleist, Heine, and many more. Under the influence of English and French philosophers, such as Locke and Voltaire, whose views Frederick broadly championed, the Germans were prodded into new paths, and new thoughts began to travel in men's minds.

NIETZSCHE

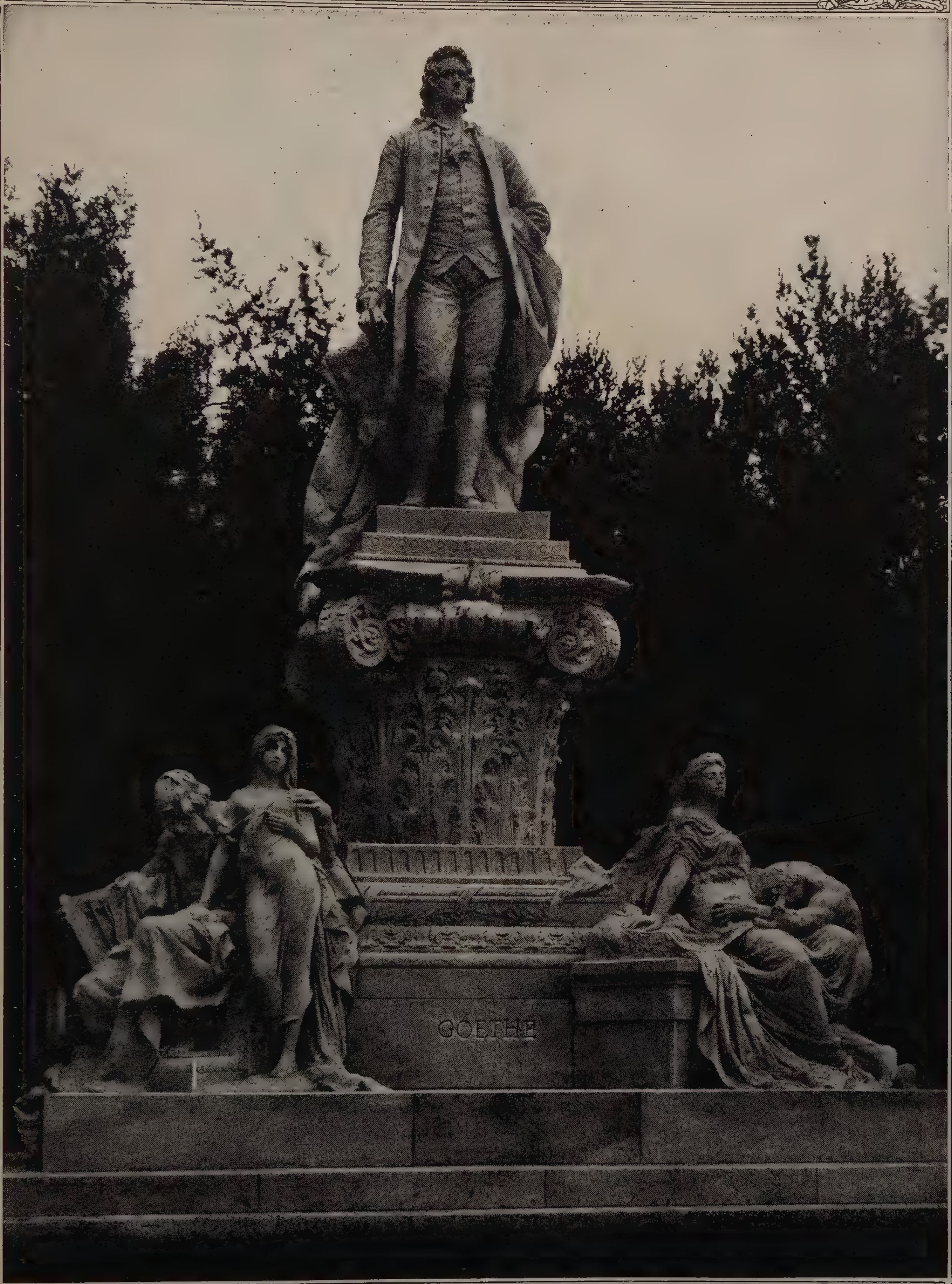


Author of the Famous Doctrine of the "Superman."

To Klopstock goes the honor of molding a new poetic language. Lessing, the first of the great German classic authors, is the master of style, the foremost German critic, who preached the harmony of content and form and banished the long gusty pages of description and high-soaring allegory. Wieland, epic poet and novelist, pioneered the way for free expression of emotion, and edged in a new and neater wit.

Then came the influence of Rousseau, the little Swiss who set France on her fateful way to the Revolution. Aided largely by the work of Herder, this

GOETHE — THE RULING GENIUS OF GERMAN LITERATURE



This striking statue of the great poet, dramatist, and philosopher — Johann Wolfgang Goethe — stands in the gardens of the Borghese Villa in Rome to commemorate Goethe's stay in Italy, during which he absorbed so much of the classic spirit. Physically Goethe recalled the Greek ideal of manly beauty — a powerful and symmetrical frame and features cast in heroic mold. On the mental side the resemblance was no less marked. He seemed instinctively attracted by the calm and majestic beauty of the classical spirit as reflected in literature and art. This feeling grew during his Italian visit and profoundly influenced his later works.

influence produced in Germany what is termed the "storm and stress" movement. People began to talk of the perfect freedom of the individual, and to rebel at tradition and authority. Politically the movement came to nothing in Germany, but in literature the effect was enormous. Writers rejected the classic laws of composition under the impression that they were proceeding in the manner of Shakespeare! The great Goethe, bearer of the brightest name in German literature, shared in the movement, and likewise Schiller, his shining contemporary. The "storm and stress" grew rapidly into the rankest sentimentalism, a sad twilight mood in which it became fashionable to feel one's self misunderstood, and revel in misery.

But presently came the sobering effect of the philosopher, Immanuel Kant, with his stern doctrine of duty, followed by Goethe's swing back toward classicism and order as the result of Italian influences. Thus this balloon of sentiment was punctured. Perhaps the laughing irony of Jean Paul Richter's novels also had something to do with sweeping away the last bits of the "storm and stress."

However, something very similar to the "storm and stress" again developed during the Romantic period which followed. This was partly due to the philosophy of Immanuel von Fichte, who denied Kant's theories, and of Frederick von Schelling, who offered the imagination for as good a guide in life as the intellect. The Romantics were individualists, obscure and capricious; but on the other hand they freed the wings of poetry, unveiled the beauties of folklore, and opened long vistas of foreign thought before the provincial German mind. And above all, from them came Heinrich Heine, the greatest lyric poet since Goethe, master of wit and irony, poet of the sea, artist of exquisite moods and of light crystalline style.

Heine lived in the years of Germany's losing struggle against the rise of absolute monarchy. In 1848 the sword drawn for German freedom was defeated by Prussian absolutism, of which the historian Treitschke was later the apologist and champion. During that period there were great names and there have indeed been many more since—Wagner, the dramatist-musician; Schopenhauer, the brilliant philosopher; Storm, famous for his idyl 'Immensee'; Nietzsche, the apostle of the "superman"; Sudermann and Hauptmann, the dramatists of modern realism. But literature labored under the yoke of commercialism and militarism, weeds almost too strong to permit ideals to flourish in the same soil.

Chief Figures in German Literature

Ulfilas (311–383)—Translation of Bible into Gothic.

Walther von der Vogelweide (1165–1230), minnesinger; national poet of Middle Ages.

Wolfram von Eschenbach (1170–1220), poet of knighthood —'Parzifal'; 'Titurel'.

Martin Luther (1483–1546)—Translation of the Bible; hymns; sermons.

Hans Sachs (1494–1576), mastersinger and dramatist—'Fastnachtsspiele' (Shrovetide Plays).

Friedrich Gottlieb Klopstock (1724–1803), classical poet — 'Der Messias' (The Messiah); odes.

Gotthold Ephraim Lessing (1729–1781) critic and dramatist —'Emilia Galotti'; 'Minna von Barnhelm'; 'Laokoön'.

Christoph Martin Wieland (1733–1813), novelist and poet —'Der goldene Spiegel' (The Golden Mirror); 'Agathon'; 'Oberon'.

Johann Gottfried von Herder (1744–1803), critic—'Kritische Wälder' (Critical Forests); 'Ideen zur Philosophie der Geschichte' (The Philosophy of History).

Johann Wolfgang Goethe (1749–1832), poet, critic, dramatist, and novelist — 'Die Leiden des jungen Werthers'; (The Sorrows of Young Werther); 'Wilhelm Meister'; 'Faust'; 'Tasso'; many lyrics.

Johann Christoph Friedrich Schiller (1759–1805), poet and dramatist — 'Das Lied von der Glocke' (The Song of the Bell); 'Wallenstein'; 'Maria Stuart'; 'Die Jungfrau von Orleans' (The Maid of Orleans); 'Wilhelm Tell'.

Jean Paul Friedrich Richter (1763–1825), humorous novelist —'Quintus Fixlein'; 'Siebenkäs'; 'Flegeljahre' (Wild Oats).

Friedrich de la Motte Fouqué (1777–1843), novelist — 'Undine'; 'Theodolf, The Icelander'.

Heinrich von Kleist (1777–1811), dramatist—'Penthesilea'; 'Der zerbrochene Krug' (The Broken Pitcher).

Jakob (1785–1863) and Wilhelm (1786–1859) Grimm—Fairy Tales.

Arthur Schopenhauer (1788–1860), philosopher — 'Die Welt als Wille und Vorstellung' (The World as Will and Idea).

Heinrich Heine (1797–1856), poet — 'Die Lorelei' and many other poems; 'Reisebilder' (Travel Pictures).

Franz Grillparzer (1791–1872), dramatist — 'Sappho'; Das goldene Vliess' (The Golden Fleece).

Hoffman von Fallersleben (1798–1874), poet and song writer —'Deutschland, Deutschland über alles'.

Friedrich Hebbel (1813–1863) dramatist — 'Judith'; 'Herodes und Marianne'; 'Agnes Bernauer';

Otto Ludwig (1813–1865) dramatist and novelist—'Der Erbförster' (The Hereditary Forester); 'Zwischen Himmel und Erde' (Between Heaven and Earth).

Richard Wagner (1813–1883), writer of operas—'Tannhäuser'; 'Lohengrin'; 'Parsifal'; 'Der Ring des Nibelungen' (The Nibelungen Ring).

Gustav Freytag (1816–1895), novelist and dramatist—'Die Journalisten' (The Journalists); 'Soll und Haben' (Debit and Credit).

Theodor Storm (1817–1888), poet, novelist, and short story writer—'Immensee'.

Gottfried Keller (1819–1890), novelist and short story writer —'Der grüne Heinrich' (Green Henry); 'Die Leute von Seldwyla' (Seldwyla Folk).

Paul Heyse (1830–1914), poet, dramatist, novelist, and short story writer — 'L'Arrabiata'; 'Kinder der Welt' (Children of the World); 'Im Paradiese' (In Paradise).

Heinrich von Treitschke (1834–1896), historian—Deutsche Geschichte im neunzehnten Jahrhundert'. (History of Germany in the Nineteenth Century).

Friedrich Nietzsche (1844–1900), philosopher and essayist—'Jenseits von Gut and Böse' (Beyond Good and Evil); 'Also sprach Zarathustra' (So Spake Zarathustra).

Hermann Sudermann (1857–), dramatist and novelist—'Es lebe das Leben' (The Joy of Living); 'Heimat' (translated as Magda); 'Frau Sorge' (Dame Care).

Gerhardt Hauptmann (1862–), dramatist — 'Die Weber' (The Weavers); 'Die versunkene Glocke' (The Sunken Bell); 'Hannele'.

Arthur Schnitzler (1862–), dramatist — 'Anatol'.

Richard Dehmel (1863–1920), poet and dramatist — 'Michel Michael'; lyric poems.

Frank Wedekind (1864–1918), dramatist — 'Frühlings Erwachen' (The Awakening of Spring).

The GERMAN LAND *and* PEOPLE

Extent.—Area of German Republic, about 180,000 square miles. Population, about 60,000,000. Latitude, 47° 16′ to 55° 53′ N. Climate, continental, with cold winters in northeast, milder in west; Rhine valley, warm summers with brilliant sunshine.

Rivers.—Danube, Rhine (Moselle, Neckar, Main, Ruhr, tributaries), Ems, Weser, Elbe (Saale, tributary), Oder, and Vistula.

Mountains.—Bavarian Alps, Bohemian Forest, Erzgebirge ("Ore Mountains"), Sudetes, Black Forest, Thuringian Forest, Taunus, and Harz Mountains.

Products.—Iron and steel manufactures, textiles (cotton, woolen, linen, and silk), beet sugar, chemicals, electrical goods, pottery, wine and beer, etc., wheat, rye, oats, barley, hops, tobacco, timber, live stock, and dairy products; herring and other fish; coal, iron, lead, copper, potash, etc.

German States (in order of area).—Prussia, Bavaria, Württemberg, Baden, Saxony, Mecklenburg-Schwerin, Thuringia (includes former states of Saxe-Weimar-Eisenach, Saxe-Meiningen, Saxe-Gotha, Saxe-Altenburg, Reuss, Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen), Hesse, Oldenburg, Brunswick, Mecklenburg-Strelitz, Anhalt, Lippe, Waldeck, Schaumburg-Lippe, Hamburg, Lübeck, Bremen.

Chief Cities.—Berlin (capital, 3,800,000); Hamburg, Munich, Leipzig, Dresden, Cologne, Breslau (over 500,000); Frankfort-on-Main, Düsseldorf, Nuremburg, Charlottenburg, Hanover, Essen, (over 300,000); Chemnitz, Stuttgart, Magdeburg, Bremen, Königsberg, Neu-Kölln, Dortmund, Duisburg, Stettin, Mannheim, Kiel (over 200,000).

This is a peasant's cottage in the Black Forest. The first story, built of stone, probably houses the horses and cows of the family, dwelling comfortably under the same roof with the good thrifty farmer folk. Yet, despite these strange lodgers, the German peasant's home is invariably spotlessly clean and neat, for the German "Hausfrau" is one of the best housekeepers in the world.

GERMANY. Where may one find a land of greater natural resources; of such charming scenic beauty, with the quaintest medievalism alongside the triggest modernity; of more splendid scientific, industrial, and artistic achievement? And where is there a people of more disciplined intelligence, real kindliness, and solid worth, combined in recent years with such hateful and dangerous ideas of militarism, national aggression, and the absolute power of the state? The creation of the German Empire by Bismarck and its amazing growth in prosperity and power was one of the stupendous events of the latter 19th century. Its collapse, through the World War, which it arrogantly began, was as dramatic and complete a downfall as that of ancient Rome or of the empire of Napoleon Bonaparte!

Before the German Empire was shorn by the Paris Peace Conference—west, north, and east—the map of Germany was not unlike the picture of a stupid helmeted giant, sprawling on all-fours, with a pigmy master atop. Prussia made up the body and head, with Berlin at the heart, and its ore and grain-bearing province of Silesia, stolen long ago from Austria, as creeping arms and hands. Schleswig, filched in 1864 from Denmark, pictured the Hohenzollern masters; while the South German states and Alsace-Lorraine formed an undefined but important lower part.

Today the picture is very different, not only in outline but in spirit. Rather is it now a crushed and huddled nation, gaunt with suffering, drawing painful breaths of desperate economic recovery and new political freedom.

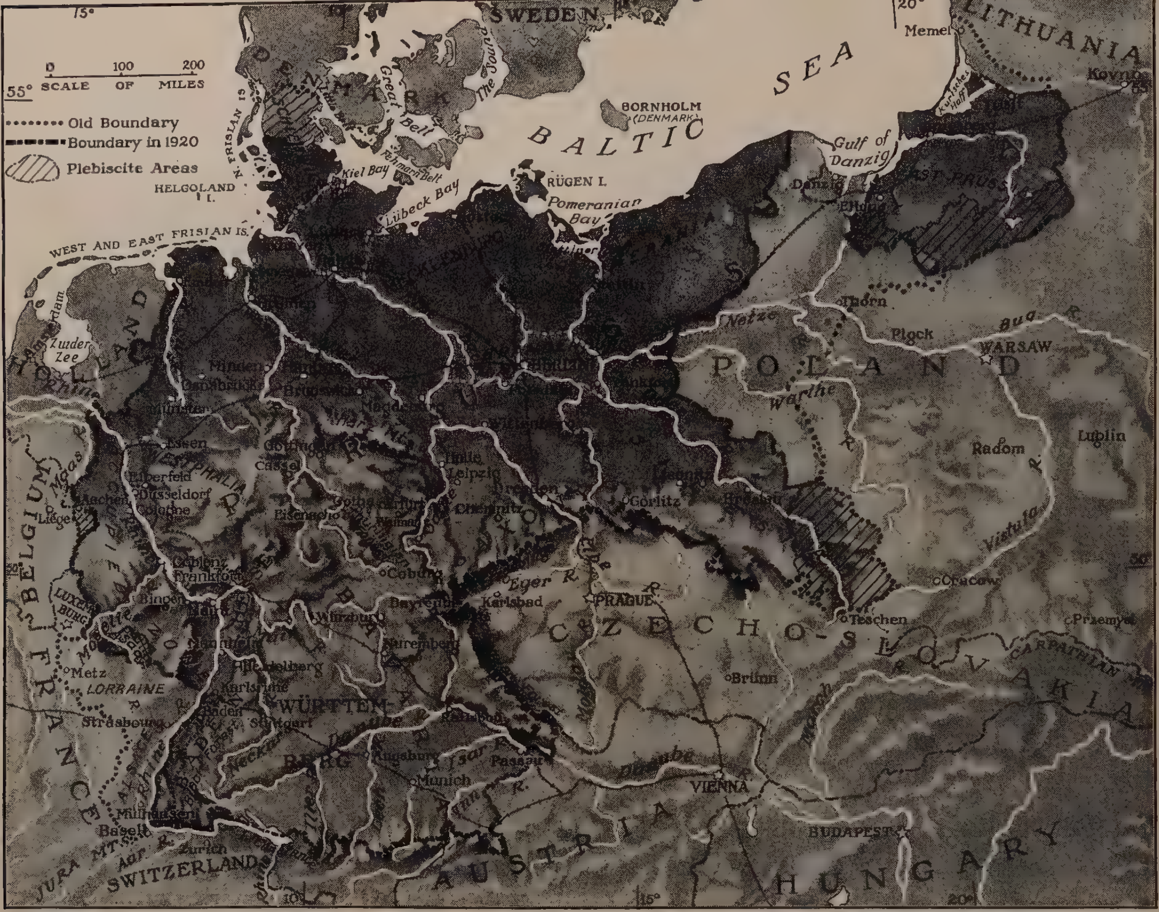
Let us begin our visit to this land by flying swift and high from southwest to northeast—the route to Berlin that the Allied airmen longed to take, but could not. A green and smiling country it lies below us, about the size of Ohio, Indiana, Illinois, and Michigan combined. It stretches from the Alps and the Bohemian mountains northwest to the Baltic and the North Sea, and from Belgium and Luxemburg on the west to the restored republic of Poland on the east.

Like a silvery ribbon the Rhine, the king of German rivers, flows from Switzerland to the sea. It is navigable as far as Basel and is connected by canals with both the Danube and the Rhone, so that commerce from its shores can pass either to the North Sea, the Mediterranean, or the Black Sea. Its falls at Schaffhausen are the largest and most picturesque in Europe. Palatial steamers bear travelers down its stream, past historic cities of the Middle Ages, past bustling seats of modern industry and commerce, to sunny vineyards on terraced hills, and innumerable heights crowned with ruined castles. The middle Rhine and the valley of the Moselle, its chief tributary from the west, produce some of the finest wines in the world. Innumerable legends, folksongs, and romantic tales cluster about this lordly river, the heart of German life and history (*see* Rhine River).

Northern Germany unfolds itself before us as a fairly uniform plain, a part of the great lowland that extends from the vast expanse of Russia to the English Channel. Across it numerous large rivers flow northward—the Ems, Weser, Elbe, Oder, and Vistula—all with large seaports at or near their mouths and navigable for steamboats either entirely across or far into the heart of Germany. An enormous amount of commerce, especially of bulkier goods, is borne on these rivers and the tributaries and 1,500 miles of canals which connect them. The chief of the German rivers are internationalized by the peace treaty so as to enable other nations to use them on equal terms.

The German plain is narrowed in the west by the Thuringian hills and the Harz Mountains (*see* Harz

GERMANY BEFORE AND AFTER THE WORLD WAR



The World War cost Germany about 15 per cent of its European territory, as you can see by following the dotted lines of the old boundary. Under the Peace of Versailles, a portion of East Prussia was given to Lithuania, and the reëstablished state of Poland received parts of Posen, Pomerania, West Prussia and East Prussia, with the nationality of several districts to be determined by plebiscite of the inhabitants. On the west, Alsace-Lorraine was restored to France, a small area went to Belgium after a plebiscite, and that portion of Schleswig-Holstein which expressed its preference for Danish allegiance was restored to Denmark.

Mountains). Like all the mountains of Germany proper, these are old worn-down ranges and are forest-covered. In places, also, low hills parallel the sandy shores of the Baltic. Forests of beech, spruce, and pine, and numerous marshy lakes are found in the east, and near the western coast desolate moors.

The sandy soil and harsh climate of the northern plain are unfavorable to agriculture, but science and patient labor produce on the great estates of Prussia and Pomerania bountiful crops of rye, barley, oats, sugar beets, and potatoes—potatoes by the millions of bushels, for these are the chief food of the German people. Indeed, in one small German town (Offenburg, in the Black Forest) stands a statue erected to Sir Walter Raleigh, as the one who first introduced this important tuber to Europe. Horses, cattle, sheep, and hogs are also raised extensively; while the turf cut from the Lüneburg moorlands supplements the coal and lignite from more favored regions.

In this northern half—the essentially Prussian part of Germany—lies Berlin, the most modern of European capitals. No American city can present a more amazing example of growth, and none anywhere such cheerless and pretentious magnificence (*see* Berlin).

Only three important ports—the quaint Hanseatic town of Lübeck, humdrum Stettin, and Königsberg—remain in the possession of Germany on the Baltic today; for Danzig and Memel are in territory taken from Germany by the Treaty of Versailles. Facing the North Sea, however, are the still thriving maritime cities of Bremen and Hamburg (*see* Bremen, Hamburg). The former naval harbor of Kiel also stands at the Baltic end of the great canal which cuts across the neck of Jutland. Excepting Kiel, all these German maritime cities are river-mouth ports. Shipbuilding and fisheries are among the most important industries in these regions.

Finally we shall notice that this northern plain, owing to its lack of protecting mountain barriers, lies open to easy invasion. Hordes of barbarian Goths, Slavs, and Tatars swept across it in far-off ages. More recently it has been a battle-ground for the

HAMBURG, THE LARGEST SEAPORT IN GERMANY

This picture shows one of the principal waterfront streets of Hamburg, which is the largest and most important of German seaports and was before the war the third largest in the world, ranking next to London and New York. Together with the city of Altona, which is continuous with it, it presents a frontage of six miles on the Elbe River, which leads to the sea 75 miles away. Hamburg also straddles the little river Alster. Handsome shops, great hotels, and fine restaurants face upon the water. Small steamers, such as those shown in the picture, are the favorite means of travel between the business center and the outlying suburbs.

armies of Sweden, Spain, and France in the devastating Thirty Years' War, for the conquering hosts of Napoleon, and the advance and retreat of Austrian and Prussian swarms. In self-defense, therefore, Prussia was compelled to become a military power with movable frontiers, and war and conquest as national industries. The tragedy of Germany was the later conversion of all Germany, including the easy-going, art-loving, philosophic south and west, to the hard Prussian doctrine that "might makes right."

Central and Southern Germany

Westward of the mountain-rimmed parallelogram of Bohemia (a Slavic state as large as West Virginia which protrudes into Germany's southern boundary) (*see* Czecho-Slovak Republic) lie the old home-lands of German culture—Bavaria and the regions still sometimes known as Swabia and Franconia. Seven hundred years ago while the original Prussians beyond the Vistula were still heathen Slavs, Franconia and Swabia were great and flourishing duchies, the bases of leading branches of the German folk, from which sprang illustrious lines of emperors. As states they have long disappeared from the map, but Baden, Württemberg, and Hesse occupy today parts of their former territory.

How welcome is the change from the Prussian north to the friendlier and more picturesque land and people of the south of the Rhineland! Instead of monotonous level plain, we have fertile valley, wooded upland, and occasional rounded mountains; and everywhere ruined castles, quaint old cities rich in historic and artistic memories, and peasant costumes for men and women gay with color and silver and velvet ornaments. To the agricultural products of the north, we here add wheat, flax, and tobacco. In Bavaria grow the hops which produce the famous German beer, and in the Rhineland are wonderful vineyards. And everywhere we see churches and shrines, for South Germany and the Rhineland are as staunchly Catholic as the north is Protestant.

Coming from France the traveler today finds Strasbourg no longer a German but now a French city, for Alsace-Lorraine was restored to France by the Paris Peace Conference. Across the frontier, in the elbow of the Rhine, lies the former grand duchy of Baden—famous alike for its picturesque Black Forest (*see* Black Forest), and for Heidelberg, the seat of a great university and a beautiful ruined castle. The former kingdom of Württemberg, with its castle-crowned, vineyarded hills and rich forest slopes, is filled with memories of old Swabian days; but its capital Stuttgart is a flourishing modern city.

These wooded highlands of the south raise the total of Germany's forest area to one-fourth of the whole

THE HOME OF THE KAISER IN THE DAYS OF THE EMPIRE

We are looking down from an airplane on the royal palace and pleasure grounds formerly occupied by the German emperors at Potsdam, 16 miles from Berlin. The palace stands in the midst of the famous Sans Souci Park. It was completed by Frederick the Great in 1769, and was the summer residence of William II until his downfall. For years the very name "Potsdam" was a synonym the world over for Prussian military autocracy.

land. Beech, oak, pine, spruce, and birch are among the most important growths. The state governments strictly control the forests, even where they are privately owned; and no one may destroy a tree without planting another. Thus the forests are never exhausted, and the evil effects on climate and soil of deforestation are avoided (*see* Forests and Forest Protection). In some parts of Bavaria the wood industries are almost the sole resources of the people. Even on the lordly Rhine great timber rafts are frequently met with floating downstream to Mainz and other furniture-making and wood-using cities.

Bavaria's Beauty and Splendid Cities

In the former kingdom of Bavaria the traveler finds not only the best of old-time Germany alongside the products of modern art, science, and industry, but also the loveliest scenery of that country (*see* Bavaria). Here only does Germany touch the Alps, for the Austro-Bavarian boundary runs along the ridge of the Northern Tyrolese or Bavarian Alps, and in the distance are seen the far-off majestic peaks of the Vorarlberg. Thoroughly Alpine are the little Bavarian towns of Garmisch and Mittenwald; and the numerous upland lakes—Chiemsee, Starnberger See, Ammersee, and the rest—are altogether lovely. The Zugspitze (9,738 feet), 57 miles south of Munich, is the highest peak in Germany. In this Bavarian hill country, also, are unique castles like New Schwanstein and Linderhof, modern built, but medieval in appearance; these were the extravagant work of Bavaria's mad, romantic, unhappy kings, Ludwig and Otto.

Bavaria's cities, too, may well be her pride. The art-loving capital Munich (*see* Munich), on the swift-rolling Isar, has a charm lacking to Berlin. Augsburg, Nuremberg, Regensburg, and Passau, each has an interest all its own. And where can Wagnerian opera be heard so well as at Bayreuth (*see* Wagner, Wilhelm Richard), or religious drama seen to better advantage than at Oberammergau?

Augsburg dates from Roman days, and bears the name of the Emperor Augustus. It is filled with memories of trans-Alpine commerce with Italy in the Middle Ages; and here may still be seen the house, rich with its frescoed exterior, of the Fugger merchant prince who lent enormous sums to the Emperor Charles V. A well-known painting pictures for us the scene when the head of this great banking family astonished the emperor by laying on the fire the promissory notes which Charles had signed, thereby releasing him from the debt. Nuremberg is so important and picturesque that it is described elsewhere.

Forty miles to the west of Nuremberg lies the little

THE FAMOUS THEATER AT WEIMAR, THE "ATHENS OF GERMANY"

Although this handsome theater was built as late as 1907, it is hallowed ground to admirers of German literature, for it stands on the site of the old theater built in 1825 under Goethe's supervision. About it cluster memories of the golden age of German drama, for here many of Goethe's and Schiller's plays were staged for the first time, and here too several of Wagner's operas had their original performance. The monument before the theater is Goethe and Schiller, whose memory dominates the whole town. Weimar was also the place where the German Assembly drew up the constitution of the Republic in 1919.

town of Rothenburg-on-the-Tauber, with city walls, town hall, and ancient churches and houses much as they were 500 years ago. It is one of the best preserved medieval cities in existence. Every year a play called 'The Master Draught' is given here showing how, in the terrible days of the Thirty Years' War, the burgomaster delivered his people from the wrath of the victorious general Tilly—by drinking without once stopping for breath a tremendous flagon of excellent Rothenburg wine!

Between these two older Germanies of the north and of the south lies a third, the gigantic growth of the last half-century—the black industrial region of central Germany. It comprises three chief areas—the Rhine-Westphalian region lying on both sides of that river north of Cologne, the Saxon districts to the northward of Bohemia, and Silesia. About Berlin also is an extensive industrial region, but it lacks the nearby coal which makes the chief advantage of each of the other areas. Not even the United States grew more rapidly in manufactures than did Germany between 1891 and 1914.

Even today, after losing the rich coal fields of the Saar basin to France and part of those of upper Silesia to Poland, Germany possesses mines of coal and iron more extensive than any other European country except Great Britain. In addition there are extensive zinc, copper, lead, and salt deposits and some gold and silver. Formerly Germany possessed almost a monopoly of the world's supply of potash and even today her mines at Stassfurt (in Prussian Saxony) are the chief source of those salts, so important for fertilizers and the chemical industry.

The Ruhr coal field, which is the richest in Europe, supplies the secret of the great Rhine-Westphalian industrial development. Its coal feeds the fires of innumerable blast furnaces, including the vast Krupp iron works at Essen, once the seat of Germany's manufacture of monster cannon, munitions, and armor plate, but now confined to locomotives, ship engines, and other peace-time work. Solingen is renowned for its knives and cutlery, Iserlohn for needles. Near by are Barmen and Elberfeld, twin cities famed for their cotton manufactures and called "the German Manchester." On the left bank of the Rhine, in the region under Allied occupation following the World War, are Krefeld, the chief seat of the German silk and ribbon manufacture, and Düsseldorf, the banking and residence center of the district. Even the factory cities show few slum districts, and German city governments and working-class legislation were long regarded as the most enlightened in the world.

ONE OF THE GREAT STEEL WORKS OF GERMANY

Here we are on the grounds of one of those great steel plants which made the city of Essen and the name of Krupp famous throughout the world. Before the World War, these huge German plants were largely engaged in turning out military supplies—cannon, shells, armor plate, etc. And the millionaire masters of these plants actively fostered the war spirit in Germany. Since the World War, they have in truth been compelled to "beat their swords into ploughshares and their spears into pruning hooks"; for the Allies made it one of the peace terms that the great German steel factories should cease making munitions of war.

The industrial district of Saxony is similarly based on the Saxon coal field. From Chemnitz and Zwickau, German stockings, knit underwear, and other goods made from imported cotton were shipped all over the world. The fine wools grown in Saxony and Silesia made these regions great centers also for woolen textiles. The clay deposits at Meissen, near the Saxon capital Dresden (*see* Dresden), give rise to potteries for the manufacture of the famous "Dresden ware." Many of the chemical and electrical industries—especially the manufacture of aniline dyes, in which Germany led the world—are located in this region. Leipzig, the seat of one of Germany's chief universities, is also one of the greatest book-publishing centers in existence (*see* Leipzig).

A highly developed railway system, supplemented by an equally highly developed system of river and canal transportation and splendid roads, aided this industrial growth. In part, too, it was due to the fostering care of the German government, and to the disciplined labor of the German people, trained to obedience and to avoid everything placarded *Verboten!* ("Forbidden"). But still more must it be credited to the patient thoroughness with which Germany, far more than any other country, applied to manufacturing the results of chemical and physical research, in which German universities led the world, and to the German system of technical schools.

Germany after the World War

Only by slow degrees can Germany recover the prosperity destroyed by her reckless policy of "World power or downfall!" The peace terms imposed by the victorious Allies at Paris were crushing. Germany was condemned to pay huge indemnities that must burden her for many years. She was forced to surrender her navy, give up most of her munitions of war, and limit her army to 100,000 men. Alsace-Lorraine, her Polish territories in the east, part of Schleswig, and the colonial empire she had been building up for over 30 years were all surrendered. Finally all her remaining territory on the west bank of the Rhine was to be occupied by the Allied armies for 15 years, as a guaranty for her faithful execution of the treaty (*see* World War of 1914–18).

A far-reaching political and social revolution accompanied the signing of the armistice (Nov. 11, 1918) and the negotiations for peace. The Kaiser had fled unlamented to Holland, the kings and princes of the German states abdicated or were deposed, and republican governments everywhere took their place.

BEAUTIFUL HEIDELBERG, CITY OF THE FAMOUS UNIVERSITY

If you were a student at the famous German University at Heidelberg, this is a view which would often delight your eyes. The town lies between lofty hills covered with vineyards and forests. We are looking down from Bismarck Heights across to the point where the river Neckar enters the plain of the Rhine. At our feet is the historic Heidelberg Castle built in the 14th and 15th centuries. The University buildings cannot be well distinguished, but they lie immediately beyond the high steeple near the left end of the picture.

A radical "Spartacan" revolt, akin to the Bolsheviki of Russia, broke out in January 1919; but it was ruthlessly put down by the moderate socialists who controlled the provisional government.

The new constitution of Germany—framed by a convention which met at Weimar, a city associated with Goethe and Schiller and far from Berlin mobs—went into effect on Aug. 11, 1919. The framework of the new government resembled that of the German Empire but the spirit was one of democracy. Germany was made a republic, with equal vote for all Germans, both men and women. The 25 federated states, now become republics, retained most of their former rights.

The president of the German Republic was to be elected for seven years by direct vote of the people. The administration was placed in the hands of a responsible cabinet, headed by the chancellor. A Federal Council succeeded to the powers of the old *Bundesrat*, but the popularly elected *Reichstag* (national council) was strengthened. The principles of proportional representation, initiative referendum, and recall were incorporated in the constitution, and it was made easier of amendment than the Constitution of the United States.

Finally, a broad bill of rights established personal liberty and equality and abolished all privileges attached to titles of nobility. The constitution also provided for the ownership of all railroads, telegraphs, and telephones by the central government, and left the door open for the full establishing of socialism by the future transfer of private business enterprises to public ownership.

Frederick Ebert, a labor union leader who had formerly been a saddler, was elected the first president, and took up the work of rebuilding in the legislative halls of Berlin that had seen the triumphs of Bismarck. The people indeed had begun to rule!

Two Thousand Years of German History

As far back as we have any record, Germans have inhabited the greater part of this land, but their remote ancestors probably came from the grass-lands of southern Russia. Romans and wandering German tribes fought one another as early as 113 B.C. While Julius Caesar was governor of Roman Gaul, which extended to the Rhine, he drove back two German tribes who had settled west of that river (55 B.C.).

THE STORIED "MOUSE TOWER" NEAR BINGEN ON THE RHINE

Countless old folk-tales and legends cling about the historic structures that dot the Rhine valley. Few of these are more startling than the legend of the Mouse Tower, which you see here at the foot of the terraced hills. This tower stands on a small island near the town of Bingen. The story goes that in the 10th century the cruel Bishop Hatto of Mainz caused a number of poor people who were clamoring for bread to be burned to death in a barn. He then took refuge in this tower, the legend runs, where he was attacked and eaten up by an army of rats as a punishment for his cruelty! It is a cheering relief from this grewsome tale to learn that it couldn't possibly be true, for the tower was not built until 200 years after the bishop was dead.

In the year 9 A.D. a Roman army was entrapped and destroyed by a German chieftain named Arminius (Hermann) in the Teutoburg Forest in northwestern Germany. About a century later the Rhine and Danube rivers were definitely established as the boundary of the empire. Their upper courses were connected by a frontier wall of earth and stone, which ran over the hills, valleys, and rivers of Swabia near the junction of the river Main with the Rhine.

The Roman historian Tacitus (98 A.D.) described the Germans as a rough barbarian people, tall of stature, with fair skins and blue eyes. They lived in rude villages in their gloomy forests, wore garments of skins, and the men spent their time chiefly in war and the chase. Their spirits were free and independent as befitted rude warriors. The women cared for the cattle and raised scanty crops. They worshiped Woden, the god of the sky; Thor, the thunder god, whose weapon was a hammer; and many other ancient deities.

Two hundred years later the Germans—now formed into great groups or nations called Goths, Franks, Frisians, Saxons, Vandals, and the like—began to press into the weakened Roman Empire. When the period of the migrations was ended, the Roman Empire had fallen in the West. Most of the barbarian conquests were absorbed into the kingdom of the Franks, which reached its height under Charlemagne (*see* Charlemagne). The break-up of the Frankish Empire in the Partition of Verdun (843 A.D.) marks the real beginning of both France and Germany as separate states.

Between the two countries lay a middle strip called Lorraine, which at this time extended westward from the Rhine to the Scheldt River and from the Vosges Mountains to the North Sea. For a thousand years this region was the object of conquest and the seat of European wars, and in 1914 Germany possessed about one-third of it. On the east Charlemagne's effective empire had extended only to the Elbe River and its tributary the Saale, beyond which line dwelt Slavic tribes. The eastward extension of German rule

A CITY OF OLD TRADITIONS AND GREAT WEALTH

Frankfort-on-the-Main is one of the most interesting as well as wealthiest of German cities. It lies at the junction of lines of railway connecting directly with all the principal cities of South and Central Germany. As the home of the original Rothschilds, Frankfort is one of the great financial and banking centers of the world. The town was settled in Roman times, and one of the legends with regard to it is that the great emperor Charlemagne, when retreating before the Saxons, got safely across the river at this point by following a doe which appeared by miracle. One of the great fairs of the Middle Ages used to be held in Frankfort.

to the Vistula and Memel rivers, with accompanying German colonization at the expense of the Slavs, was the work of another ten centuries.

The conversion of the Germans to Christianity was the work of Irish monks and then of the Englishman, St. Boniface, the "Apostle to the Germans" (*see* Boniface, Saint). The Saxons of North Germany, however, remained heathen until the time of Charlemagne, when they were converted by the sword.

For several hundred years after 843 Germany was divided into a number of great "stem duchies," each the home of a separate stem or branch of the German people. The chief of these duchies were Bavaria, Swabia, Franconia (on the middle Rhine and its tributary the Main), and Saxony (from the Ems River to the Elbe, north of Franconia). The Franconian duke was the first to become German king after the ending of Charlemagne's line (911). Then for five generations the Saxon dukes wore the crown. The greatest of this line was Otto I, the Great (936–973), who revived Charlemagne's empire. It included Germany and Italy, but not France. Following the Saxon kings the Franconian (or Salian) house again ruled. In its time the empire was convulsed by a great "Investiture Conflict" between church and state, led by the Emperor Henry IV (1056–1106) and Pope Gregory VII (Hildebrand), and their successors. After the Salian emperors came the Hohenstaufens, so called from their castle in Swabia. Frederick I, called Barbarossa or "Red Beard" (1152–1190), and his grandson, Frederick II (1215–1250), were the most important of the Hohenstaufen emperors, and each of those rulers also was engaged in long conflicts with the papacy.

Feudalism and the attempt to rule Italy along with Germany broke up the stem duchies into a thousand or more fragments. Everywhere arose robber barons, who ruled from their hill-top castles by *Faustrecht* ("fist law"). Italy, as was said by Rudolf of Hapsburg (1273–91), the first of his house to become emperor, was "the den of the lion," with many tracks leading in and none coming out. So Germany remained an elective monarchy, weakened by its connection with Italy, while France, England, and Spain were building up strong national kingdoms based on the principle of hereditary rule.

But the strength that ebbed from the German kingship grew in the hereditary princely states. The Golden Bull (1356) of Charles IV definitely fixed the right to elect the emperor in the "Seven Electors"—the archbishops of Mainz, Cologne, and Treves, the Margrave of Brandenburg, the Elector of Saxony, the Count Palatine of the Rhine, and the King of Bohemia. By confirming the powers of these and other princely states, and of the numerous "free cities," Charles IV "legalized anarchy and called it a constitution."

Even Charles V (1519–56), who in addition to Germany ruled the Netherlands, Spain, Austria, Naples, and Sicily, and large parts of the New World, was unable to put down the Reformation started by Luther, and one of the chief reasons was the support given it by the rulers of important German states. The terrible Peasants' War of 1525, in which the people of Swabia and Franconia sought to free themselves from the bonds of serfdom, only riveted their chains more firmly. The great religious struggle called the Thirty Years' War (1618–48) weakened the central power still further. Thenceforth the head of each of the several hundred German states was practically an absolute ruler, and the Hapsburg emperor was a mere figurehead, without power save in Austria and his other hereditary lands. Disunited Germany was depopulated, commerce almost destroyed, and the people burdened with heavy taxes to support the incessant wars.

SUNDAY IN A GERMAN VILLAGE

The people of the Black Forest are noted for their quaint costumes. On Sunday it is the custom for old and young to array themselves in their best finery, and after church to saunter through the village streets chatting and gossiping. These villagers are mostly makers of clocks, toys, and musical instruments.

But the latter part of the 18th century brought promise of better things. Frederick the Great increased his kingdom of Prussia at the expense of Austria and Poland by most unscrupulous war and statecraft, but he made his possessions a strong well-ordered state. He thus prepared the way for a closer union of Germany, under a new and stronger headship than that of Austria. At the same time intellectual Germany flowered forth in a national literature in which the names of Herder, Goethe, Schiller, and Arndt represent the choicest blossoms. An idealistic philosophy, immortalized by the works of Immanuel Kant, Fichte, Schelling, and Hegel, was mother of the fruits of this period.

The wars waged against Europe by Revolutionary France and Napoleon also helped, though again Germany was left trampled and bloody in the wake of battle. The crushing defeat of the Prussians at Jena (Oct. 14, 1806) compelled a reorganization of that kingdom, in which serfs were set free and the beginning made of the Prussian military system based on the principle of universal service. The mockery of the title "Holy Roman Emperor" was also at last ended when Francis II resigned that title and became simply emperor of Austria (1806).

After the fall of Napoleon the Congress of Vienna (1814–1815) grouped the German states—now reduced from several hundred to 39, including Austria—into a loose German Confederation. Its only head was a diet or assembly, composed of delegates appointed by the sovereigns, which met at Frankfort-on-the-Main. The powers of the diet were so feeble as to make it a laughing stock. It was only a veil behind which was concealed the inevitable rivalry of Austria and Prussia for leadership.

When the wars of democratic revolution from France again burst over Europe in 1848, the liberals of Germany—under men like our own Carl Schurz—arose in rebellion and demanded democratic government and a strong and united Germany. But when the German imperial crown—with Austria left out—was offered by them to King Frederick William IV of Prussia, he contemptuously refused it as one "picked up out of the gutter." A united Germany without Austria and without Prussian leadership was impossible and the revolution therefore failed. The movement for German unity lagged for another score of years.

The actual creation of the new German Empire was the work of Bismarck (*see* Bismarck, Otto von). For years he was Prussian delegate to the Frankfort diet, and so was in the thick of Austrian and Prussian rivalry for the German headship. He believed that only on the field of battle—by "blood and iron"—could that issue be settled. By skilful maneuvering Bismarck brought about war with Austria in 1866. Prussia's rival was decisively defeated at Sadowa (Königgrätz) and forced to submit to a reorganization of Germany which excluded Austria. The states of Hanover, Hesse-Cassel, Nassau, and the free city of Frankfort, which had supported Austria, were ruthlessly annexed by Prussia. The other German states north of the river Main then united with Prussia in a North German Confederation (1866–70). South Germany was left out, for Bismarck knew it must ultimately join unless France blocked his plans.

Four years later Bismarck tricked France also into declaring war, in which she was crushingly defeated and Paris taken. France was forced to pay a billion dollars' indemnity, and cede Alsace-Lorraine to Germany. The enthusiasm aroused by this war brought the south German states into the new Prussian organization. It was completed by the proclamation in the French royal palace at Versailles (Jan. 18, 1871), of the new German Empire, with the king of Prussia as perpetual German Emperor (Kaiser).

In the popularly elected Reichstag, or legislative chamber, Prussia had 236 representatives out of 397, and the assembly's power was so limited that it was at times called "the Hall of Echoes." The real power lay with the Prussian war-lord as emperor, who claimed to rule by "divine right," and with the Bundesrat or Federal Council. The members of this body were delegates appointed by the sovereigns of the German states. Here Prussia had 17 votes (plus three of Alsace-Lorraine after 1911) out of a total of 61. The chancellor, who headed the administration, was responsible only to the emperor and not to the Reichstag.

The dream of centuries was achieved. Germany was united, but in the saddle was militarist Prussia with its belief in war as the handmaid of diplomacy and the state as the ultimate end. Would the easy-going, artistic, philosophical, individualistic, and literary south be able to curb militarism and the spirit of conquest allied now with all the great business interests of the new Germany?

Under the skilled leadership of Bismarck as chancellor, in the reigns of Emperor William I (1871–88) and Frederick III (March–June, 1888), the new empire grew rapidly in vigor, industrial prosperity, and power. Troubles arising with the Church of Rome were settled. Far-sighted laws were passed giving pensions under government control to laborers disabled by accident, sickness, or old age. The beginning was made of a colonial empire which ultimately included about 1,000,000 square miles in Africa (Togoland, Kamerun, German Southwest Africa, German East Africa) and 100,000 square miles in China and the Pacific islands (Kiaochow Bay in Shantung province, Kaiser Wilhelm's Land in New Guinea, Bismarck Archipelago, Caroline Islands, etc.).

Two years after the accession of Emperor William II (1888–1918), Bismarck was abruptly dismissed by the impetuous young Kaiser. The latter's aggressive foreign policy, hostility to the Hague conferences, increases of the army, naval rivalry with England, flirting with "Pan-Germanism," and support of Austria in the Balkans, together with such projects as the Berlin-to-Bagdad railway extending German commerce and the threat of her military power to the Persian Gulf and the Suez Canal; above all, his incessant "rattling of the sword" in its sheath, demands for "a place in the sun," and boasts that nowhere in the world should any great decision be reached "without Germany and the German Emperor"—those were the things which marked the general prussianizing of Germany. In a world divided into hostile alliances and resounding with military and naval preparations, such a tone and policy indicated to an uneasy world what would be Germany's line of conduct at any time the military party thought the strategic moment had come in any one of the constantly recurring European crises after 1908. (*See* World War of 1914–18; *also* separate articles on chief German mountains, rivers, cities, and historical characters.)

MAN'S DEADLIEST FOE—*The Microbe*

Tiny Organisms Revealed by the Microscope which Cause Many of Our Bodily Ills—How Science Fights Their Poisons—The Endless Battle Waged against Them by the Blood

If you told a savage who was ill with typhoid fever that the cause of his suffering was a creature so small that 10,000 of them put end to end would be less than an inch long, he would probably reply bitterly that you were taking advantage of his weakness to spin fairy tales. "Don't I know," he would say, "that an evil spirit has brought this upon me?" No magician or witch-doctor ever conceived of a creature half so startling as a microbe, a form of life so small it cannot be seen by the unaided eye, yet it claims more victims than all wars, fires, floods, earthquakes, and other deadly agencies put together.

GERM THEORY OF DISEASE. Most diseases, we now know, are due to the presence in the body of exceedingly tiny vegetable or animal organisms, which produce poisons that attack the system. These poisons interfere with the functions of the body, cripple or destroy its various organs, bring about decay and often death. This is believed to apply to nearly all diseases in men, beasts, and even trees and plants, although the germs of some diseases have not yet been discovered.

We must remember that the world about us—soil, air and water, plants and animals—is filled with millions of invisible living beings called *micro-organisms*, from the Greek *mikros* meaning "small." These may be of the vegetable type, called *bacteria*, or the animal type, called *protozoa;* the difference is not important here. The great majority of these creatures are not harmful to man, even aiding him in many useful ways. (*See* Bacteria.) But others start a work of destruction as soon as they enter the human body, in the air breathed into the lungs, with the food we eat, or through the pores or cuts in the skin. These are the disease germs. In ordinary medical speech they are all grouped together as

TYPHOID BACILLI

These germs cause typhoid fever. Notice the "flagella" or tails.

bacteria. These are divided into *bacilli* (rod-shaped), *cocci* (round), and *spirilla* (corkscrew shaped). The term "microbe" is a popular name for all bacteria. The development of powerful compound microscopes in the 17th and 18th centuries had shown the existence of many micro-organisms, but it was not until the middle of the 19th century that their activity in producing disease was established. At that time, scientists observed that a particular form of bacillus was always found in the blood of cattle and sheep afflicted with anthrax, a violent disorder that killed thousands of the animals every year and even attacked human beings. But this observation was merely a beginning. To prove that these bacilli were the real cause of anthrax, they had first to be isolated, that is, separated from all other substances found in the blood of the diseased sheep or cattle. This was done, in 1863, by Robert Koch, a noted German bacteriologist. The anthrax bacilli then had to be grown in what is called a "pure culture"—that is, allowed to multiply under artificial surroundings without losing their poisonous strength. It was not until 1876 that Koch accomplished this and arranged the final test. A few perfectly healthy sheep were chosen for the experiment. In the presence of several eminent scientists, a quantity of the liquid containing the anthrax bacilli was injected into the blood of each of the sheep. Within a few days all had contracted anthrax and died. This is believed to have been the first conclusive proof that any specific disease is caused by a specific germ.

TRYPANOSOMES

These protozoa are injected into man's blood by the bite of the tsetse fly and cause the deadly sleeping sickness.

The anthrax experiment started a long chain of successful discoveries and tests which are continuing to this day. Scientists have isolated, one by one, the bacteria of blood-poisoning, erysipelas, cholera, typhoid fever, bubonic plague, pneumonia, meningitis, influenza, yellow fever, diphtheria, tetanus (lockjaw), tuberculosis, leprosy, whooping cough, and a score of other diseases. In the case of smallpox, measles, mumps, and a few others, no specific microbes have yet been observed, but they give all indications of being true germ diseases. Among the principal ailments which have been traced definitely to animal organisms (protozoa) are malaria, amoebic dysentery, and sleeping sickness.

Certain diseases which appear to be due to improper food, like beri-beri and pellagra, have not yet been placed in the germ class, although the faulty diet is believed by many authorities to be simply the agency which opens the way for some form of bacterial infection. Even in certain other disorders, which are traced to the failure of specific organs to function properly, and which are not classed as diseases in the strict sense, the question of indirect germ influence is sometimes raised.

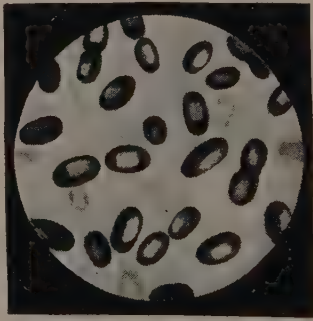
Disease germs do their deadly work by forming poisons or "toxins" in the system. The symptoms of a disease depend upon the nature of these poisons and the positions in the body occupied by the germs which generate them. Some germs remain in the blood stream, which carries their poisons to all parts of the system. Others seek out special organs like the lungs, the stomach, the liver, the intestines, and the effects of their poisons are felt most powerfully in these localities. Certain toxins, like those of hydrophobia, attack principally the nerves, spinal cord, or brain.

Probably the greatest benefit resulting from the discovery of the germ theory was the fact that it solved most of the mystery of how diseases spread. By studying the habits of germs, scientists discovered how they grow, how they travel from place to place, and how they enter the human body. They learned that few disease germs can live long in the open air and sunlight, but that many thrive, like the typhoid bacillus, in impure water and milk, or like cholera germs, in various kinds of food which have been exposed to infection. It was found also that the meat of diseased animals often carried bacteria.

The entrance of many other microbes has been traced to cuts and scratches in the skin; this is true of the "micrococci" of blood-poisoning and erysipelas. In many of the so-called contagious diseases, like diphtheria, germs may be transferred by clothing or anything which has come in personal contact with one who has the disease.

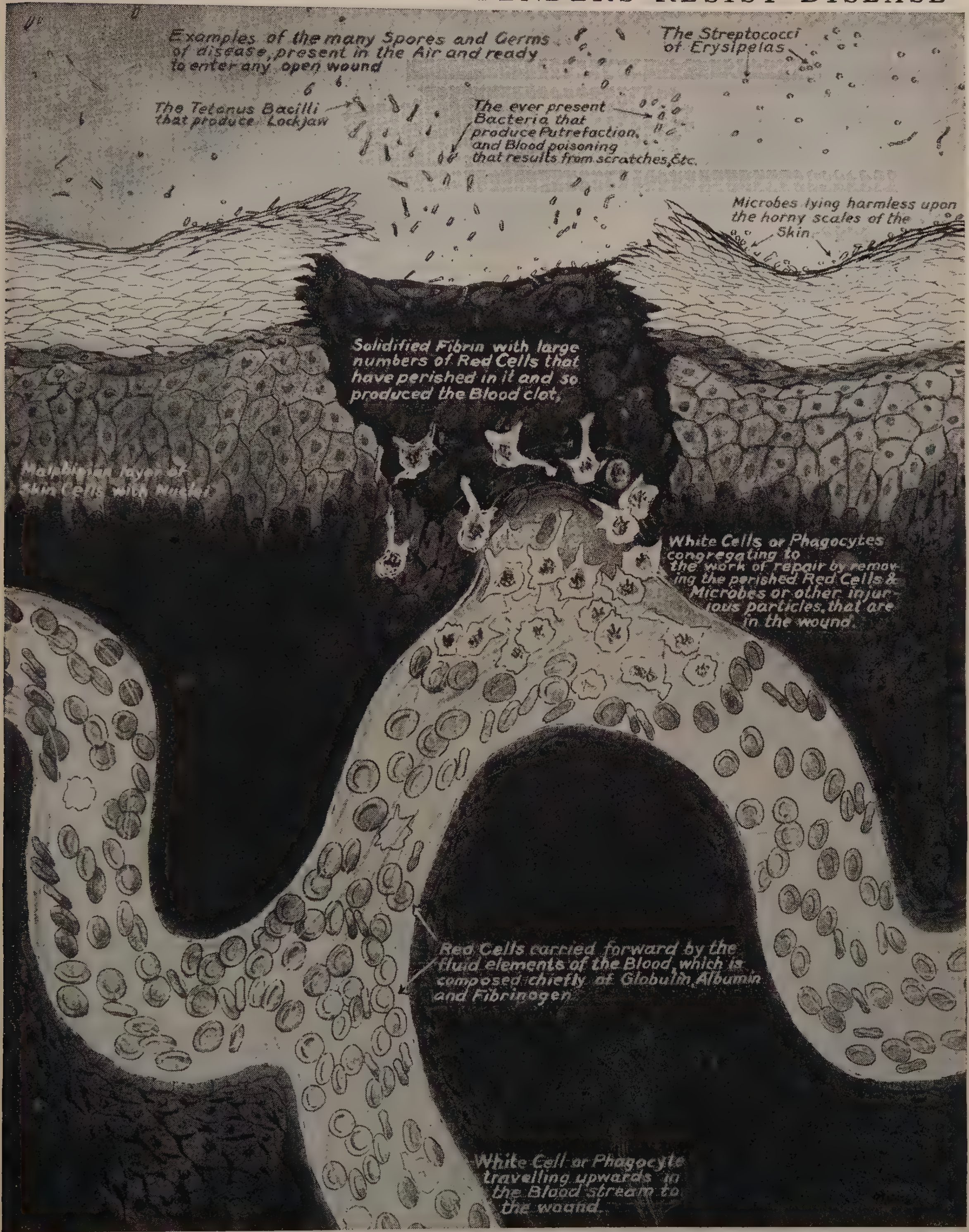
Perhaps the most amazing of all these discoveries was that many deadly germs enter the body through the bites of insects. Malaria and yellow fever, for instance, are transmitted solely by certain types of mosquitoes (*see* Mosquito). Sleeping sickness is carried from person to person by the tsetse fly (*see* Tsetse

PLAGUE BACILLI



They look mild, but they have killed millions with bubonic plague.

HOW OUR INVISIBLE DEFENDERS RESIST DISEASE


Examples of the many Spores and Germs of disease, present in the Air and ready to enter any open wound
The Streptococci of Erysipelas
The Tetanus Bacilli that produce Lockjaw
The ever present Bacteria that produce Putrefaction, and Blood poisoning that results from scratches, Etc.
Microbes lying harmless upon the horny scales of the Skin
Solidified Fibrin with large numbers of Red Cells that have perished in it and so produced the Blood clot,
Malpighian layer of Skin Cells with Nuclei
White Cells or Phagocytes congregating to the work of repair by removing the perished Red Cells & Microbes or other injurious particles, that are in the wound.
Red Cells carried forward by the fluid elements of the Blood, which is composed chiefly of Globulin, Albumin and Fibrinogen
White Cell or Phagocyte travelling upwards in the Blood stream to the wound.

Here the artist has pictured on a greatly enlarged scale what goes on in a portion of skin no larger than the head of a pin, when disease germs try to enter through a cut or broken place. Beneath the skin is a tiny capillary, with blood passing through on its normal errands. When the skin breaks, the blood of course rushes into the opening. Contact with the air dries it into a clot which fills the wound. But imbedded in this clot are disease germs which had been quick to take advantage of the opening. The blood at once takes up the fight. Certain fluids—"bactericides"—try to kill them directly, by chemical action. Other fluids—"opsonins"—try to make them digestible for the white blood cells or phagocytes. These cells swarm to the point and eat the "predigested" germs. You can see several of them with their "meals" already inside. If the body is in good condition and the germs not too malignant, the blood will win; if not, the germs make good their entrance and disease begins.

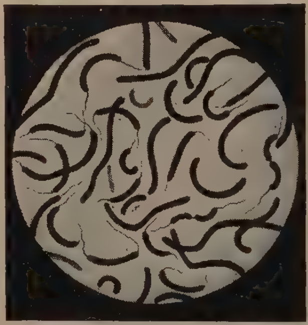
Fly). The bubonic plague is transferred to human beings by fleas which have bitten diseased rats (*see* Black Death; Flea; Rat). Typhus fever, which scourged some of the war-ridden countries of Europe so terribly during the World War of 1914–1918, is apparently carried by the body-louse.

DIPHTHERIA BACILLI

Thanks to antitoxin, these germs have lost much of their terror.

While the danger from germs of all kinds must be carefully considered by persons who wish to avoid disease, this danger must not be exaggerated. Not every disease germ which enters the human body actually causes trouble; otherwise we would be ill most of the time, for we take in germs with nearly every breath and every mouthful of food and drink. In the blood and tissues of all healthy persons there is a tendency to resist and destroy unwelcome visitors. Many individuals, in fact, seem to be naturally immune to certain maladies; the germs can get no foothold in them. It is when the body is allowed to weaken through bad habits, overwork, improper food, insufficient exercise, etc., that microbes find themselves able to launch their deadly work.

CHOLERA GERMS

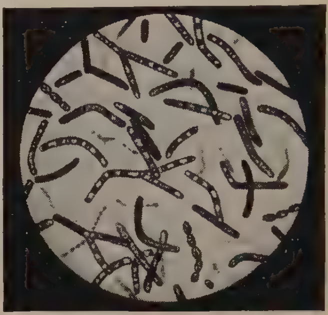


These bacteria are of the "corkscrew" or spirillum type.

Few germs are able to penetrate the human skin. The favorite breeding places of the *streptococci* or pus germs are the teeth and the mucous membranes of the nose, mouth, and throat. And these streptococci not only produce a great many disorders themselves, but they are a sort of advance agent, paving the way for other disease germs. Breathed in from the air, they find lodging perhaps in the folds of the tonsils, and if the tonsils have been weakened by mouth-breathing, by dust-laden air, by exposure to extreme heat or cold, the germs may thrive and start forming pus, which soon gets into the blood stream and infects the whole body. Or maybe the teeth, through improper care, become refuges for germs. Perhaps decay has opened a door to the tender nerve fibers which run up through the roots or perhaps the disease called *pyorrhea* has loosened the gums so the germs find their way far into the teeth sockets. In any case, pus pockets may be formed, which after a time cause little or no pain but which nevertheless poison the entire system producing rheumatism, abscesses, and a general low physical morale, which invites disaster. Certain forms of heart disease and of pneumonia, certain cases of appendicitis, and even gall-stones have been traced to germ infections in remote parts of the body.

There are three ways of fighting the diseases caused by germs: (1) by the general destruction of the germs; (2) by preventing them from entering the human body; (3) by overcoming their evil effects, after they have made their way in. The first of these methods is usually carried on by public sanitation, which strives to do away with the breeding places of germs by disposing of sewage and garbage, by keeping water supplies free from contamination, and so on (*see* Health Department). The second method is illustrated by personal cleanliness, using disinfectants in wounds, the proper care of the mouth, nose and throat, boiling drinking water, fumigating sick-rooms, etc. (*see* Antiseptics). The last method includes the whole field of curative medicine and surgery, with particular emphasis on vaccine and serum treatments, and the use of specific drugs (*see* Antitoxins).

THE "WHITE PLAGUE" GERM



These curious striped bacilli are the cause of the dreaded tuberculosis.

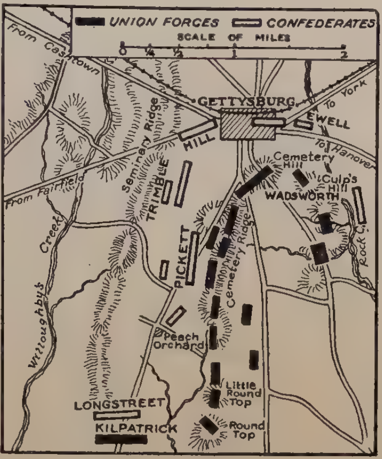
Despite all that has been done to solve the problems of medicine since the discovery of disease germs, there still remains an immense field for the scientist to explore. Almost every day a microscope, focused on a spot no bigger than the head of a pin, uncovers some life-saving secret, and the world knows no greater heroes than the men who devote their lives in obscure laboratories to the battle against man's worst foe—the microbe.

GERRYMANDER (*gĕr′ry-măn-dẽr*). In 1812 the Democratic-Republican party was in power in Massachusetts, but could not hope to retain its control in the approaching elections. To save something for the party, the legislature passed and Gov. Elbridge Gerry, later vice-president, signed a reapportionment bill constructing at least one representative district of exceptional unfairness. A Federalist editor, wrathful at the trick that was played upon his party, hung a map showing this district over his desk where all might see it. Gilbert Stuart, the famous painter, noticed the monstrosity one day, and with his ready pencil added head, wings, and claws, exclaiming, "That will do for a salamander." "Better say Gerrymander," growled the editor, a bitter opponent of Governor Gerry. The uncouth name for this political trick passed into current use, and today is to be found in any dictionary of the English language.

The "gerrymandered" district may be a city ward, a legislative district, or a congressional district. The purpose is to pack hostile majorities into two or three populous districts, leaving the rest "safe" for the party in power and thus giving it a larger number of representatives than its votes really warrant. One famous southern congressional district in which the negro vote was concentrated was 300 miles long and 20 wide. Happily an aroused political conscience has diminished the number of such extreme cases of gerrymandering.

GETTYSBURG, BATTLE OF. "The most terrific combat on record"; "A great and glorious victory for the Potomac Army"—these were some of the headlines that appeared in Northern newspapers on July 4, 1863, after the close of the three days' struggle at Gettysburg, Pa. The South had expected a victory that would soon bring peace. For a time it seemed that they would not be disappointed, but in the end they failed, and from that time the tide of war set against the Confederacy.

THE CLIMAX OF GETTYSBURG



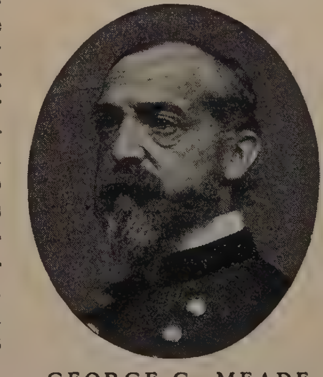
After unfruitful attacks on Round Top and Culp's Hill on July 2, Lee sent his assaulting columns, led by Pickett's division, against the Federal center on Cemetery Ridge on the afternoon of July 3. When this attack also failed, Lee accepted defeat and withdrew from Northern soil.

In June 1863, General Lee had decided to carry the war into the North by an invasion of Maryland and Pennsylvania. This, he thought, would strengthen the peace party of the North, which was loudly demanding peace at any price. It would also give Virginia a chance to rest from the ravages of war, and if successful it might win some of the European nations to recognize the Confederacy as an independent nation. The time seemed ripe for the undertaking. The armies of the North were not in good condition. The terms of enlistment of many of the men had expired, and the commander of the Federal troops, General Joseph Hooker, already discredited by his defeat at Chancellorsville (May 1863), had resigned just a few days before the battle of Gettysburg as the result of a disagreement with the administration at Washington; General Meade was but newly appointed to take his place.

ROBERT E. LEE
Commander of the Confederate Army.

For two weeks General Lee had carried all before him. He had begun to cross the Potomac on June 15, had passed through Maryland, burned Chambersburg, Pa., and was pressing on towards Harrisburg, the capital of the Keystone State. For a time Northern leaders feared an attack on Washington, but when it became evident that invasion of Pennsylvania was Lee's object, Meade followed in hot pursuit.

Advance parties of the Confederate and Union forces met in conflict on July 1. Some of the Confederate troops were on their way to the village of Gettysburg to get the shoes of which they were sadly in need. There they met a detachment of Union troops, and the battle began. Success was with Lee's men on that first day. They drove the Federal forces back through Gettysburg, and captured their positions on Seminary Ridge. Meade meanwhile posted his main forces on Cemetery Ridge and next day Lee attacked each flank in turn. He won ground but his successes were not decisive. On July 3 therefore he staked all upon one grand attack against the center.



GEORGE G. MEADE
Union Commander at Gettysburg.

On the afternoon of July 3, the flower of the Confederate army, 15,000 strong, led by Pickett's division, advanced to the assault, a solid wedge of men. "Regiment after regiment and brigade after brigade moved from the woods. The red flags wave, their horsemen gallop up and down; the arms gleam in the sun, a sloping forest of flashing steel." A mile across the valley lay the Union troops, calmly awaiting the coming storm, while over their heads their artillery poured a hail of shot and shell into the advancing ranks of the enemy. Pickett's men were mowed down like grain. Great gaps appeared in their lines, but these were immediately closed. Their thinning ranks swept on until a small remnant, led by the gallant Armistead, crossed the Federal lines on the crest of Cemetery Ridge. The Stars and Bars waved over the Union defenses. But the price had been great:

A thousand fell where Kemper led;
A thousand died where Garnett bled;
In blinding flame and strangling smoke
The remnant through the batteries broke
And crossed the line with Armistead.

The few who remained could not hold what they had won at such a terrible cost. Attacked on all sides

THE TENTED FIELD OF GETTYSBURG, 50 YEARS AFTER

This city of tents is the temporary home of thousands of old soldiers of the Civil War, the "Blue" and the "Gray" together. These men, who years before were locked in deadly battle on the same field, met in friendship to help celebrate the 50th anniversary of the battle of Gettysburg, July 1 to 4, 1913. More than 7,000 tents were pitched on the field, a convincing testimony to the completeness with which the wounds of the Civil War had healed.

they threw down their arms and fled. Lee's great assault, one of the most desperate charges in all history, had failed.

There was nothing left for the Confederates but retreat. Slowly, on July 4, Lee gathered his men about him and started on the way back to Virginia. If Meade's army had not been worn out by the three days' fight it might have ended the war then and there. But Meade felt that his battered men were in no condition to pursue, and Lee was allowed to recross the Potomac in safety.

The Turning Point of the War

The battle put an end to Lee's hopes of invading the North, and it did far more. Up to that time, some political leaders of England had been strongly inclined to recognize the Confederacy as an independent nation; but when the news of Gettysburg flashed over the world, it put a halt to such projects.

Thus the turning point in the war was reached with the victories at Gettysburg and Vicksburg, which occurred at the same time. The struggle continued for nearly two years longer, and was marked by terrible battles; but from this time the strength of the Confederacy steadily declined, while the power of the Federal government as steadily increased.

Today the little town of Gettysburg stands in the midst of the silent memorials of the battle which was waged about it more than 50 years ago. A national cemetery, containing the graves of 3,629 soldiers, was laid out on Seminary Ridge, and at its dedication on November 19, 1863, President Lincoln delivered his famous Gettysburg Address. In 1895 the whole battlefield became a national park, within which are over 2,000 monuments, markers, and tablets, erected by states and regimental associations to show the visitor the spots where the different troops took part in this great conflict. In the World War it was taken as a training ground for the Tank Corps, and sons of the South and the North, now in the same uniform and under the same flag, camped where their forefathers had fought and fallen.

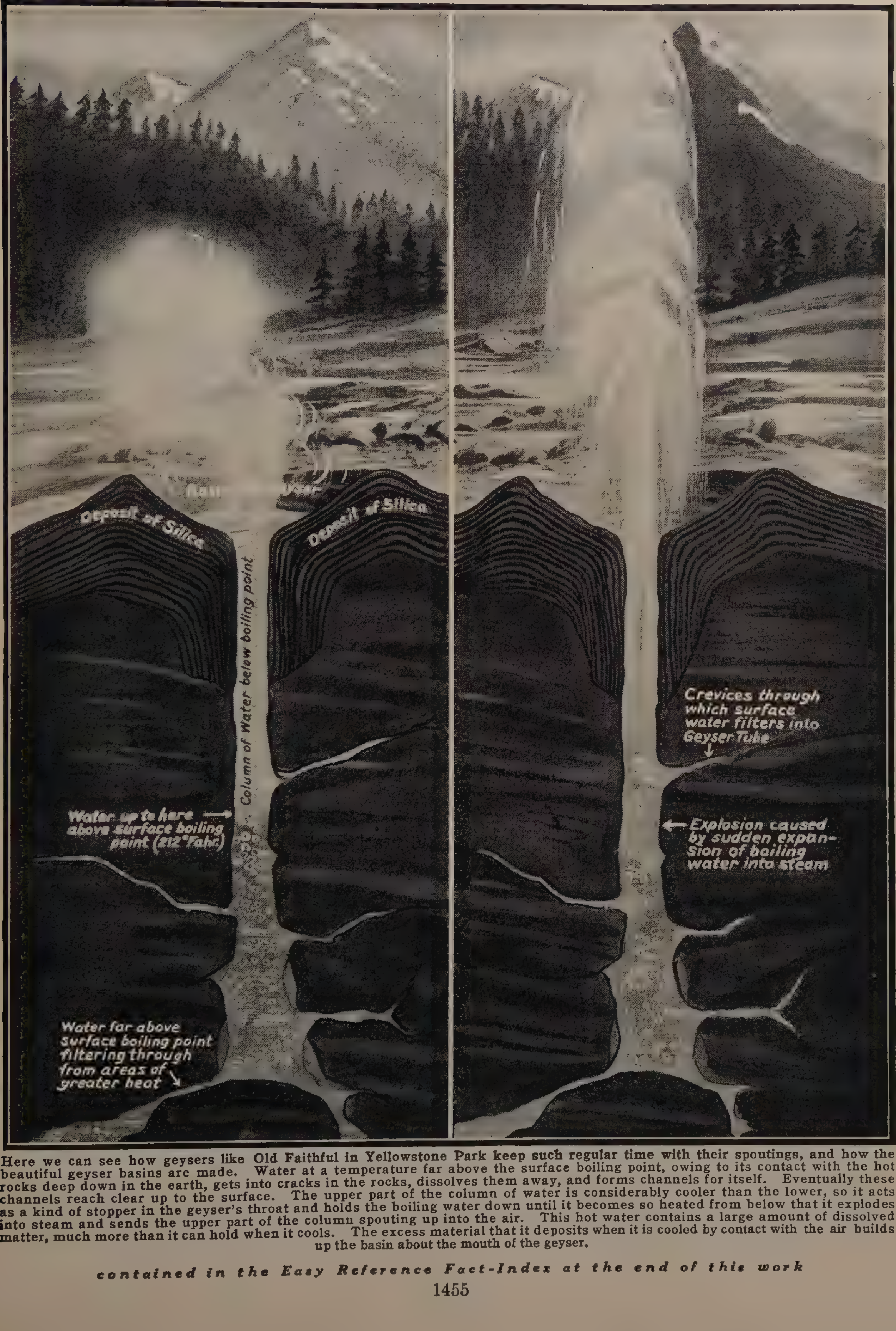
GEYSER. A hot spring which breaks forth in an eruption every now and then is called a geyser. They occur in certain regions of the earth which were formerly volcanic and which have retained considerable heat near the surface.

A typical geyser consists of a crater with a funnel-shaped opening into the earth. From this opening, at fairly regular intervals, a column of hot water and steam is ejected, sometimes to the height of a few feet, and sometimes to a height of 150 feet, as in the case of the geyser known as Old Faithful in Yellowstone Park. Until about 1870 Iceland was considered the principal seat of geysers, but we now know that Yellowstone Park contains more geysers than all the rest of the known world. New Zealand also has some noted geysers.

What Makes a Geyser Spout?

The action of a geyser was first explained by the chemist Bunsen, of Heidelberg, who went to Iceland in 1847 and made an elaborate study of the Great Geyser in that island. The water gathers in the deep throat of the geyser, becomes heated until the lower portion is changed into steam, when it flings the column of water above it violently into the air. Deposits of mineral matter, which was in solution in the ejected water, are often made about a geyser in the form of one or more basins. The deposition of the mineral matter is due partly to the cooling of the

THE PULSE BEATS OF THE BOILING GEYSER


Deposit of Silica
Deposit of Silica
Column of Water below boiling point
Water up to here → above surface boiling point (212°Fahr.)
Water far above surface boiling point filtering through from areas of greater heat
Crevices through which surface water filters into Geyser Tube
← Explosion caused by sudden expansion of boiling water into steam

Here we can see how geysers like Old Faithful in Yellowstone Park keep such regular time with their spoutings, and how the beautiful geyser basins are made. Water at a temperature far above the surface boiling point, owing to its contact with the hot rocks deep down in the earth, gets into cracks in the rocks, dissolves them away, and forms channels for itself. Eventually these channels reach clear up to the surface. The upper part of the column of water is considerably cooler than the lower, so it acts as a kind of stopper in the geyser's throat and holds the boiling water down until it becomes so heated from below that it explodes into steam and sends the upper part of the column spouting up into the air. This hot water contains a large amount of dissolved matter, much more than it can hold when it cools. The excess material that it deposits when it is cooled by contact with the air builds up the basin about the mouth of the geyser.

water, partly to evaporation; but chiefly to the influence of minute plants (*algae*), which live about the geysers, and which have the power of extracting silica, etc., from solution. The beautiful colors of the deposits about geysers are due to the presence of the plants themselves. Some of the geysers of Yellowstone National Park throw up mud instead of water.

GHENT (*gĕnt*), **BELGIUM.** "It is the soul of Flanders, at once venerable and young. In its streets the past and present elbow each other." Thus the Belgian writer Maeterlinck describes Ghent, a thriving modern town which has yet many remnants of old-world charm. In it are the famous Cathedral of St. Bacon, a number of old gild houses and monasteries, and a nunnery founded in the 13th century, surrounded by walls and moats, and resembling a miniature town. In the center of the city the belfry still stands in which used to hang the bell "Roland" that called the citizens of Ghent to arms on the approach of enemies. There is much to remind the visitor of the medieval days when the city was the center of a great cloth industry and the home of the turbulent and wealthy burghers—"the sovereign town of Flanders for power, counsel, lordship, situation, and all that one can imagine as belonging to a good and noble town."

Ghent is a picturesque city, with a network of canals spanned by more than 200 bridges. Only eight miles in circumference, it contains extensive promenades and gardens and is sometimes called the City of Flowers. Situated where the Lys and Scheldt rivers meet, and connected with the ocean by a ship canal, it has considerable commerce in agricultural and manufactured products in addition to a large export trade in flowers. Though not so conspicuous for manufacturing as in the Middle Ages, it has many important industries. Chief among the city's enterprises are cotton-spinning, flax-spinning, cotton-printing, tanning, and sugar-refining.

The early history of Ghent is the usual history of Flemish towns—an endless series of quarrels between the townsfolk and their lords, between the aristocrats and the bourgeoisie, and against the rival city of Bruges. Two of the most famous of the insurrections were those led by Jacob Van Artevelde and his son Philip in the 14th century. Population, about 165,000.

GHIBERTI (*gē-bĕr'tē*), **LORENZO** (1378–1455). In the year 1403, in the beautiful Italian city of Florence, 34 judges sat with puckered brows vainly trying to decide which of two models for a pair of bronze doors was the more beautiful. The models were the best of those presented in a competition held to decide who should make the new doors for the Baptistery of Florence, a building which had once been the cathedral of the city, but which was now used chiefly for baptismal services. But the judges' brow-puckering did no good, for they could not decide which of the models should have the prize.

Then one of the young sculptors, Brunelleschi—he who a few years later left sculpture for architecture and constructed the wonderful dome of the great new cathedral near by—stepped forward, and, saying that his rival's model was more beautiful than his own, withdrew his design from the competition. The young man whose work so impressed his big-hearted rival was Lorenzo Ghiberti, and the bronze doors which he executed when he had thus won the competition are among the many beautiful works of the Renaissance.

But far surpassing these in beauty and difficulty of casting are his marvelous second pair of doors for the Baptistery, executed by this great Florentine artist some years later. On these Ghiberti worked for more than 25 years. The subjects of their sculptures are stories of the Old Testament, and in some of the ten panels are as many as a hundred separate figures, modeled upon different planes in accordance with the newly studied laws of perspective. In the first are pictured the creation of man, the creation of woman, and the expulsion from Eden; in the second, the sacrifice of Abel, with Cain's oxen plowing in the foreground. Other panels picture the story of Noah, of Abraham, of Jacob and Joseph, of Moses, Joshua, David, and Solomon. Only less beautiful than the figures and background of these marvelous doors is the border of statuettes and busts surrounding each and the decorative frieze of fruits and birds and beasts that frames the whole.

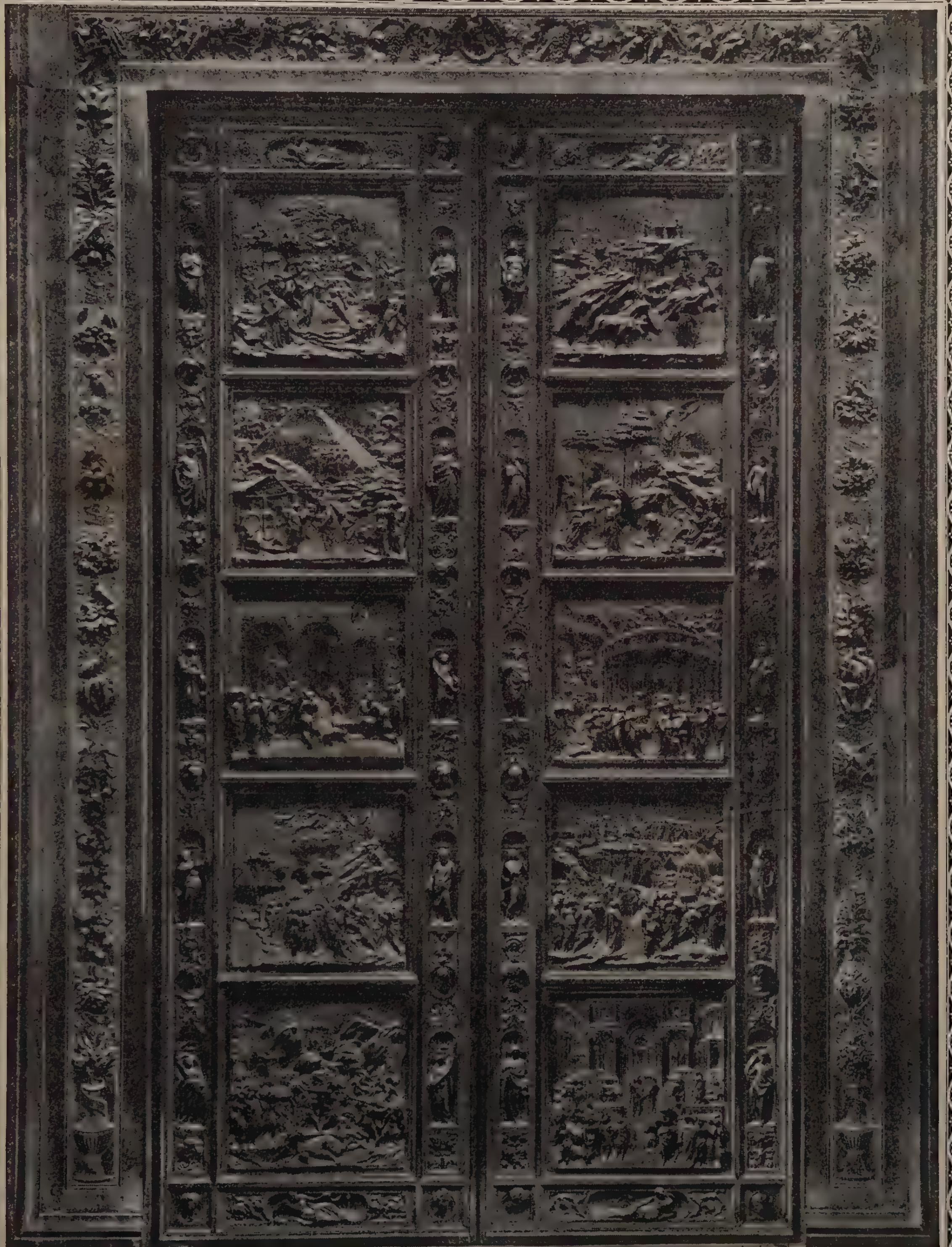
The great Michelangelo, a hundred years later, being asked what he thought of these doors replied: "They are beautiful enough for the gates of Paradise."

Ghiberti's early training, like that of many other artists of the Italian Renaissance, was as a goldsmith, and the skill in minute detail which he thus learned never deserted him. When at 25 he was given the commission to execute his first pair of doors, several assistants were given him, among others his stepfather, also a goldsmith. The stories told in it are stories of the life of Christ and of the fathers of the church, and the modeling and casting took 21 years. All the people of Florence took the keenest interest in Ghiberti's work, paying patiently large sums of money for 50 years out of their taxes, and watching the designs grow with interest that never failed.

The double character of the Renaissance—enthusiasm for antiquity and enthusiasm for visible nature—are both shown very clearly in Ghiberti's second pair of doors. Ghiberti also executed several statues and reliefs and designed some of the most beautiful stained glass in the cathedral of Florence. He died at 77 years, full of honor and piety, caring nothing for money but only for his art and the religion it had been used to beautify.

GIBBONS, CARDINAL JAMES (1834–1921). The second American to be made a cardinal of the Roman Catholic church—the first being Cardinal McCloskey of New York—was James Gibbons, one of the outstanding figures in American public life. Born in Baltimore on July 23, 1834, he was taken by his parents to Ireland where he obtained his childhood education. He returned in 1848, living for a time in

THE MOST FAMOUS DOORS IN THE WORLD



This second set of bronze doors made by Ghiberti for the Baptistery of Florence are regarded as among the world's greatest masterpieces. "They are beautiful enough for the gates of Paradise," said Michelangelo when he saw them for the first time. Ten stories from the Old Testament are illustrated in those panels, and the details of the figures, the perspective, and the decorations are worked out with exquisite accuracy and grace. It was Ghiberti's early training as a goldsmith joined to his genius as a sculptor which enabled him to achieve such delicate beauty.

New Orleans. He was graduated from St. Mary's Seminary, Baltimore, and ordained a priest in 1861.

In 1866 he was appointed first vicar-apostolic of North Carolina with the rank and title of bishop. His work was marked with a thoroughness and success which led to his promotion to the see of Richmond in 1872. Here his zeal and ability were further demonstrated, and in 1877 he became coadjutor to Archbishop Bayley. On the death of the latter in the same year, Bishop Gibbons became archbishop of Baltimore. He presided at the plenary council of Baltimore in 1884, and Leo XIII, approving of the acts and decrees of this council, created him cardinal in 1886. In this high office he showed the qualities of a wise and able prelate, and gained wide influence, not only as a leading churchman but as a progressive and patriotic citizen.

JAMES CARDINAL GIBBONS

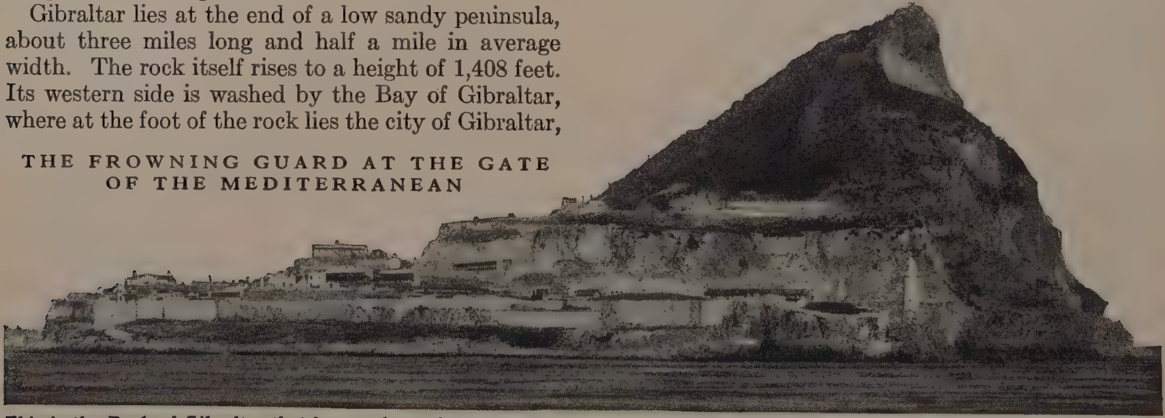
Famous American Churchman and Public Leader.

GIBRAL'TAR. Like a reclining lion dozing in the southern sun, the great rock of Gibraltar looks sleepily across the 12 miles of water which separate this southernmost point of Spain from Ceuta, on the African side of the strait leading into the Mediterranean. But in case of need this peaceful-seeming rock can leap into thunder and flame from powerful cannon which lie hid in many a waterside or rock-hewn battery. For Gibraltar for over 200 years has been a garrison and crown colony of Great Britain, her chief naval base on the Mediterranean route to India. The fortifications are so strong that the rock is considered impregnable. The eastern side is so steep as to be altogether secure from assault.

Gibraltar lies at the end of a low sandy peninsula, about three miles long and half a mile in average width. The rock itself rises to a height of 1,408 feet. Its western side is washed by the Bay of Gibraltar, where at the foot of the rock lies the city of Gibraltar, with a population of about 25,000, including the garrison of between 5,000 and 6,000 men. Aliens are not allowed to reside in Gibraltar without a special permit from the British authorities, and every effort is made to prevent the increase of population. At the northern end of the rock is an open space, part of which, lying between the British and the Spanish lines, is called the "neutral ground" and is uninhabited. Six miles across the bay from Gibraltar lies the Spanish town of Algeciras, where an international conference on Moroccan affairs was held in 1906.

Gibraltar, with its opposite African cape (where lies the Spanish town of Ceuta), was called by the Greeks the "Pillars of Hercules" and was once thought to be the western limit of the world. Gibraltar takes its name (Jebel-al-Tarik, "hill of Tarik") from the Mohammedan chief who led his troops across the straits in 711 A.D., captured it, and built a fortress there. In 1704 it was captured from the Spaniards by the British, and has remained in their possession ever since. It has endured many sieges, especially the great one of 1779–83, when for four years the garrison held out against a joint besieging force of French and Spaniards. This is regarded as one of the most memorable sieges of history. The culminating episode was the grand attack in September 1782, by a fleet especially equipped with massive wooden armor. Every attacking ship was finally blown up or burnt to the water's edge by cannon-balls heated red hot and fired from the Gibraltar batteries.

THE FROWNING GUARD AT THE GATE OF THE MEDITERRANEAN



This is the Rock of Gibraltar that looms above the narrow western entrance of the Mediterranean. Its peak is 1,400 feet above the sea, and hidden in its rugged sides of pale gray limestone are countless great British guns, commanding the 12-mile passage which separates Europe from Africa. Europa Point, on which the lighthouse stands, is the most southerly projection of the rock. The public gardens, the barracks, and the docks are situated on the Atlantic side.

ONE OF THE OLD GILD HOUSES

Here is a fine example of one of the old gild houses, the Kaufhaus, or Merchants' Hall, in Freiburg, Germany. The gilds built such halls to serve as meeting places and headquarters, and made them as handsome as their prosperity would permit.

GILDS. In every important town of Europe during the Middle Ages the men of each trade were organized into associations known as craft gilds for the purpose of regulating their occupations and preserving a monopoly. The weavers seem to have been the first to organize, but later the goldsmiths, saddlers, fishmongers, bakers, dyers, glovemakers, and many other occupations, some with only a handful of workers, formed separate fraternities. In the larger cities like Paris and London there were in the 14th century as many as 50 or more different gilds. Usually they were authorized by the local governments, but sometimes they obtained a charter from the king.

SHOPPING IN THE DAYS OF THE GILDS

Here my lord and his family are out for an afternoon of shopping. The merchant's apprentice is showing a fine piece of cloth and no doubt enlarging on its merits. My lord seems to be exclaiming at the price, while the merchant indicates by his fingers that he will reduce the price to this important customer.

The rules of the gild provided that no one who was not a member should practice the trade within the town. Membership in some places was acquired as a matter of course by any artisan who reached a required degree of skill; but at other times and places it was jealously guarded, descending to sons or being obtained by marriage.

The gild regulations required that all articles made and sold by their members should be of a certain quality. There must be, for instance, according to the rules of the weavers' gild, a certain number of threads to the inch in standard cloths. The hours of labor were regulated, and work on holidays and at night prohibited. In later times insistence on outworn standards and processes became a handicap in industry, and led to a shifting of manufactures to villages and new towns where gilds were not established.

Other gild regulations provided for mutual assistance, the care of sick and needy members, and of members' widows and orphans. Once a year—sometimes oftener—the members gathered for a feast (the word "gild" means "feast" or "payment"), and in summer, usually on Corpus Christi day, they often gave one of the miracle plays popular at the time (*see* Miracle Plays). Since the members of a craft usually lived on the same street, the craft gild was a natural center for the interests of its members.

Membership in a gild was ordinarily obtained by passing through an apprenticeship. The young craftsman was bound out by his parents to an employer for a number of years—usually seven—during which time he was fed and clothed and lodged with the master's family, above or behind the shop. When his apprenticeship was finished he became a "journeyman" (so called from the "wander year" in which he perfected himself in the craft by working about in other cities), and served for wages and worked for whomever he pleased. If he were ambitious and saved enough of his wages to start a small shop of his own, he might possibly become a master, with journeymen and apprentices under him, and could then take part in all of the meetings of his craft and hold office.

In addition to the craft gilds there were older and more powerful organizations called "merchant gilds," composed of men who made a business of buying and selling and engaged in what we should call wholesale trading to distant places. It was members of such organizations who formed the great Hanseatic League that was such a power in the Baltic lands, and even had quarters in the steelyard of London. On the continent the merchant gilds had a great influence in the city government, and the gild hall of the merchants is today one of the striking buildings in many a European city. Many non-industrial gilds existed, mostly founded for charitable and religious purposes.

GINGER. The history of ginger goes back to a remote period in India. The Greeks and Romans imported it, and during the Middle Ages it was next in value to pepper, a pound costing as much as a sheep. It was the first of the oriental spices to be grown in the New World, and as early as 1550 Jamaica exported a large amount to Spain. It is an important commercial crop in India, China, West Africa, in the West Indies, and in Central America. Jamaica ginger is the finest and most valuable.

Ginger spice is made from the root-stocks of a perennial reedlike plant, similar in appearance to our iris or flagroot. Ginger is marketed in two forms, preserved or green ginger, and dried or cured ginger. China supplies practically all of the preserved ginger, which is prepared with sugar syrup or honey. For dried ginger the root is dug out after the leaves of the plant have withered. When the skin is left on it is known as "black ginger"; when it has been removed before drying, it is "white ginger." The essence of ginger used in flavoring is a tincture of ginger and alcohol.

Scientific name of common ginger plant, *Zinziber officinale*. The plant usually grows to a height of about two feet. The flowers are yellowish-white and fragrant. Another important member of the ginger family is *turmeric*, whose powdered roots are used as a yellow dyestuff, as a condiment (especially in curry powder), and in medicine.

GINKGO (*ġink′ḡō*). This peculiar tree, native to China and Japan, is the sole survivor of a genus once widely distributed over the world. Its fernlike leaves have given it the English name, "maidenhair tree," and the beauty of its foliage has caused its adoption as a shade tree in many sections, especially in Washington, D.C., where it is extensively planted along the streets and in the parks. The ginkgo is a graceful tree, with numerous slender branches, which form a cone-shaped head. The fruit, about the size of a small plum, has a disagreeable odor and falling makes an unsightly litter on the walks and lawn, which probably accounts for its not being more widely cultivated. The kernel of this fruit is edible and when roasted has a taste like maize; it is used as a food by the Chinese and Japanese. The ginkgo is not known in a wild state, having been preserved from extinction by its cultivation in the temple grounds of China and Japan, where it is considered a sacred tree.

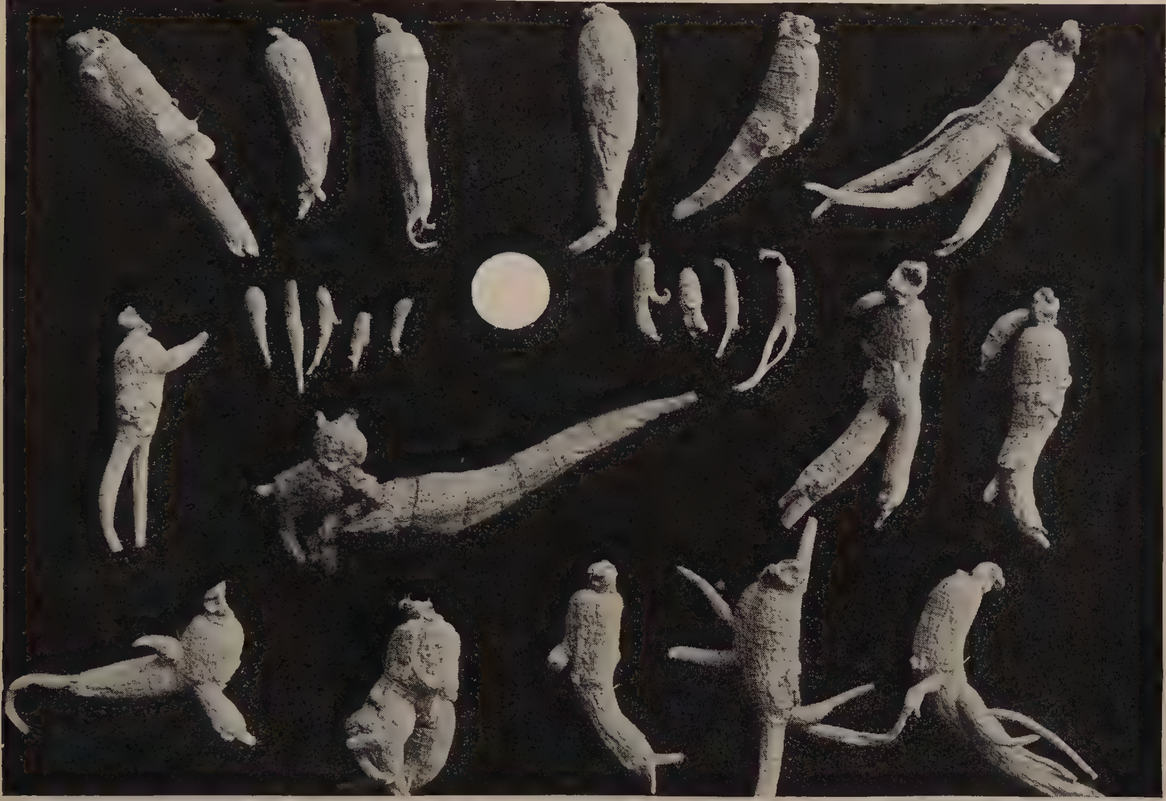
GINSENG (*ġĭn′sĕng*). Many are the tales the Chinese tell of the wonderful cures that ginseng has wrought. They will tell you that its roots are a remedy for every illness, that they are able to prolong life and even to restore it after death; and their legends recount how the wolf, tiger, and snake protect this miraculous plant from harm, and how the roots save themselves from capture by moving from place to place underground. And so, although our own physicians regard it as of little value, the Chinese still buy it at any price. Many country boys keep their eyes open in summer for the three-leaved stalks and scarlet berries growing in the deeper woods, and sell the small parsnip-like roots for three or four dollars a pound.

SCARLET BERRIES OF THE GINSENG

If you should see in the woods clusters of scarlet berries like these you will know that beneath them in the ground are the roots which the Chinese prize so highly as medicine.

The most valuable ginseng—sometimes worth $200 an ounce—comes from Korea or Manchuria, and an

CURIOUS SHAPES TAKEN BY GINSENG ROOTS



This ginseng is ready for market. The size of the roots is indicated by the white circle which represents the comparative size of a silver dollar. The nine smaller samples near the circle are specimens from an Oriental dealer, and show the kind of roots his trade demands. Those with "human" forms are the most valuable.

inferior quality is cultivated in Japan. It was first discovered on the American continent in Canada, and later was found to be growing in eastern United States. Most of the wild ginseng has now disappeared, and a cultivated plant is taking its place. But the wild variety always commands better prices because of the Chinese superstition which prefers roots resembling a man or some grotesque being (gin-seng means "form of man") rather than the regular roots which cultivation tends to produce.

Ginseng belongs to the genus *Panax*. *Panax ginseng*, a native of China, and *Panax quinquefolium*, of eastern North America, are the most noted species.

GIOTTO (*ġŏt'to*) (1267?–1337). An enchanting bell-tower of variegated marble piercing the skies of Florence with restrained ethereal grace, its surface adorned with beautifully pointed windows, slender columns, exquisite statues and reliefs—this is the world-famous "campanile" of Giotto di Bondone, the great Italian artist who stood at the dawn of the Renaissance. It is impossible to overestimate the beauty of this square tower of red, black, and white marble, rising in five stories over 275 feet—all of it Giotto's design and part of it (such as the first course of sculptured medallions, a wonderful series representing primitive arts and industries) actually the work of his own hand. No wonder a Florentine's expression for perfect beauty runs, "as beautiful as Giotto's tower!"

But it is as a painter and not as a sculptor or architect that Giotto is perhaps best known in the world. Born in Vespignano, a few miles north of Florence, he early showed his artistic ability. The story is told that Cimabue, "the father of painting," discovered him as a boy of 12 drawing one of his father's sheep on the ground with a pointed stone, and, attracted by his talent, made him his protégé and pupil. Soon he began to adorn church walls with wonderful "frescoes" of saints and biblical characters painted on the fresh-laid plaster—pictures that in those days served as a people's Bible. His earliest works are at Assisi, the birthplace of St. Francis, in whose church he painted some scenes in the life of that most lovable of saints. Later the pope called him to Rome, ordering a series of mosaics and paintings. These Giotto so beautifully executed that soon dukes, princes, and kings competed for his services.

There is an oft-told story of how Giotto sent the pope a specimen of his work. "Giotto took a sheet of paper and a pencil dipped in red color, then resting his elbow on his side to form a sort of compass, with one turn of his hand he drew a circle so perfect and exact that it was a marvel to behold." Thus originated the Italian phrase, "as round as Giotto's 'O'."

Giotto's life was crowded with work. The great poet Dante was his friend and helped him choose subjects for many of his paintings. In the Palace of the Podesta at Florence is a series of Biblical scenes painted by Giotto, and among the bystanders he gives us portraits of Dante and Brunetto Latini, Dante's teacher. For centuries whitewash overlaid these frescoes, but in 1841 fragments were recovered and freely "restored." In the 38 masterly paintings of the life of Christ and the Virgin, of the Last Judgment, and other Biblical scenes which Giotto executed for the Arena Chapel in Padua he reached the supreme height of his genius. Giotto's frescoes indeed are found in almost all large Italian cities, some of the most superb being those in the Church of Santa Croce, Florence.

Giotto's last years were spent in Florence as chief architect of the Florentine Cathedral, and in working on his campanile, both of which were left unfinished at his death in 1336. He was buried in the cathedral with great honors. Over a century later Lorenzo de' Medici erected a fine monument to him with an epitaph which truthfully says: "Lo, I am Giotto—what need is there to tell of my work? Long as verse lives, my name shall endure!"

Among the most famous of Giotto's paintings are his passionate and dramatic 'Death of St. Francis' and 'Ascension of St. John', in the Church of Santa Croce, Florence; his portrait of Dante, also in Florence; his 'Christ before Caiaphas', and his simple and beautiful 'Visitation of Mary to Elizabeth', in Padua. These and others of his paintings reveal to us the simple original genius of the greatest painter Italy produced before the flowering of the Renaissance, an artist who despite his lack of knowledge of anatomy, and of technical laws of perspective, foreshortening, etc. (to which art had not yet attained), was yet the first to get away from the old conventional ideals of his time, and to paint with deep feeling and dramatic skill real people in real attitudes.

GIOTTO'S TOWER

"An enchanting bell tower of variegated marble piercing the skies of Florence, its surface adorned with beautifully pointed windows, slender columns, statues and reliefs — this is the world-famous campanile of Giotto, the great Italian artist."

GIPSIES. Have you ever, going down a country road, rounded a corner and found in a secluded spot a family of gipsies camping? Probably their covered wagon, painted with gay colors, was drawn up in a little patch of woods, with perhaps a little tent beside it. Over an open fire a young gipsy woman with liquid black eyes and very white teeth was bending, cooking something for dinner. She was dressed in full gay skirts, a fringed shawl of many colors was wrapped about her shoulders, and shining gilt bangles hung and glistened in her hair and at her throat. A lithe and swarthy man lounged by her side in a bright sash and dirty clothes, a child or two peered elfishly from the wagon at you, and an incredibly ugly old hag with withered hands like claws muttered something in a strange incomprehensible jargon. Have you seen this? And has your mother told you never to go near their camps, because gipsies steal things and kidnap children? And have you gone on your way, half fascinated and half afraid, wondering who these strange people may be, where they came from, and why they spend their lives in this way?

If you have asked yourself these questions you have done what many wise scientists have done. And if you have found no answer, they have not done much better. For the gipsies are one of the strangest problems to be found anywhere in the study of races. They live in the midst of settled civilization, yet they are not of it; they pitch their little tents in all the countries of Europe, western Asia, northern Africa, North and South America, and Australia; yet wherever they go they speak dialects of their own which vary from country to country yet always keep certain main characteristics, so that gipsies from many countries can understand one another. They have no religion of their own, most of them are unlettered and ignorant, and they know almost nothing of their own former history.

The gipsies are as distinct in physical characteristics as the Jews. In character they are boastful, quick-tempered, and quick-witted, generous

LIFE IS CAREFREE IN A GIPSY CAMP

A happy lot, aren't they, these gipsy children? This photograph was taken in a gipsy camp in England, and shows their happy-go-lucky way of living. A number of families will travel about, pitch their tents on commons near towns and villages, and earn money by horse-trading, mending cane chairs, telling fortunes, and doing odd jobs of tinkering.

to their own clan and grasping towards outsiders, fond of gaiety and bright colors, and with no very clear idea of property rights. They are wonderful musicians, playing the fiddle and the guitar with a wild charm and singing many old folksongs and ballads. The women tell fortunes and practice tricks of various kinds. Many of the men are tinkers or traveling smiths, while others are horse-traders.

The English name "gipsy" comes from an old idea, once believed almost universally, that the gipsies came from Egypt; and they themselves, apparently not knowing where they really did come from, accepted this and said they were from a mythical country called "little Egypt."

The first clear traces of the gipsies are found in the islands of the Mediterranean and in the Balkan peninsula. They appeared in Germany about 1417, and soon little bands of them had spread over all the countries of Europe. As they live by their wits, and usually at the expense of the poor people, they soon got themselves disliked, and in spite of a safe conduct given them by the Emperor Sigismund, who was also king of Hungary, attempts were made to get rid of them. At various times and places severe laws were made against them, and they were branded, tortured, and even executed. But ultimately these laws were modified, though only in rare places have the gipsies even today given up their old habits of wandering and settled down. Of the countries of Europe, Hungary, Russia, and Spain have the largest number. The total number of gipsies is estimated at 700,000. The language they speak, which is like no one European language, shows at least some resemblances to East Indian dialects. There are 14 different dialects of the "Romani chib," as they themselves call their language in Europe. These dialects are becoming more and more corrupt, mixing other words of all sorts in with the Romani words, and adopting the grammar of the country where the gipsies find themselves.

A gipsy calls himself "Rom," the man, or the husband, his wife "Romni," and his language "Romani." And it is safe to say that so long as the little tents and covered wagons roam the open country of the world, so long as the gipsy "patteran," or trails, lead over the heaths and along the roads, and the light of their fires glows at night in lonely places, "Rom" and his companions will be a source of mystery and dislike to his more settled neighbors.

GIRAFFE. If you had never seen a giraffe or a photograph of a giraffe, you might from its description be inclined to say that it was a wholly imaginary creature, out of 'Alice in Wonderland'. For no more grotesque-looking figure could be imagined than this African animal, which zoölogically is intermediate between the deer and antelopes.

The giraffe is the tallest of all living mammals, its head rising from 16 to 20 feet from the ground. This height, however, is not due to the size of its body, which is smaller than the body of the average horse, but to its exceedingly long and slender legs, and its even more extraordinary neck, which alone is often as long as the body of a tall man. When it drinks the giraffe has to straddle its legs far apart to reach the water.

You may ask, Why did Nature produce such a freak? As usual science has an answer ready. The giraffe dwells in a country where grass is scarce; its food consists of leaves. But the trees in such regions are almost bare of branches for quite a distance from the ground; therefore the giraffe has developed a long neck and long legs to enable it to browse comfortably on the tops of such trees. Its tongue is in keeping with this purpose, for it often measures a foot and a half in length.

Having produced such a strange creature, Nature also undertook to "camouflage" it for protection by giving it a spotted skin of brown and yellow. As the giraffe stands among the mimosa trees (its favorite feeding place), its skin resembles the play of light and shadow through the leaves, so that it is exceedingly difficult to detect (*see* Protective Coloration).

The giraffe's back slopes downward from the shoulders to the tail; and its shoulder blades project at right angles to the body so that the chest is very much wider than the rump. The neck, which has a short soft mane, is surmounted by a delicate head. Between the ears are two bony horn-like projections covered with skin and each surmounted with a tuft of bristles. In front of and between these projections is a rounded bony elevation which appears like an undeveloped third horn. In one form both males and females possess horns; but usually the horns are confined to the males. The eyes of the giraffe are described as wonderful in beauty of coloring and in expression. The upper lip is long and is used, together with the tongue, in grasping food. The hoofs are cleft and dainty in shape. The knees and hock-joints are covered by callosities like those of the camel. The hide is thick and covered with short soft hair. The nostrils are prominent and can be closed at will like those of the camel.

The movements of the giraffe are as curious as its structure. It cannot trot, but it runs in a ponderous gallop. The Arabs hunt the giraffe with their fleetest horses and yet find difficulty in overtaking it. The flesh is in great demand for food, the skin is used for leather, and the tail-tuft is used for fly-brushes.

In their native state giraffes are usually found in small herds. They chew their cud while standing erect, and wary hunters have sometimes come upon specimens leaning against trees, fast asleep.

HE HAS THE LONGEST NECK IN THE WORLD

What an advantage the giraffe would have in a crowd! He could see over everybody's head. But his long legs and neck were not built for sightseeing, as much as to enable him to eat the foliage from trees, for he lives in a country where the grass is scarce or dried out by the intense heat, so he must dine on leaves. Can you imagine anything more awkward in appearance than this creature? Yet it can run very swiftly.

The giraffe is entirely without a voice. No one has heard it utter a sound even when wounded. But the sense of sight and hearing are acutely developed and it is very intelligent. Although it is good-natured and gentle, it will fight in self-defense and use both head and legs as weapons. The head on its long neck can be used like a sledge-hammer to deal heavy blows. It is said that in defense of her young a female giraffe has been known to kill a lion.

Giraffes were known to the ancient Egyptians and Greeks, and many were exhibited in the old Roman games. They were thought to be a mixture of camel and leopard, and were called "camelopards"—a name which has clung to them in their scientific classification today.

The range of these animals formerly extended throughout the breadth of the African continent from the Indian Ocean to the Atlantic and in prehistoric times included even portions of Europe and Asia. But they are now confined to the plains of eastern Africa, between the Sahara desert and the valley of the Zambezi.

Until the beginning of the 20th century the giraffe was the only known member of its family, the *Giraffidae*. But in 1900 an English naturalist and explorer learned from African natives of the existence of an animal called the *okapi*, which was unknown to civilized man. A skin and two skulls of this animal were secured and sent to England for identification. It was declared to be a near relative of the giraffe, though much smaller and without the characteristic long neck of its larger brother.

GIRL SCOUTS. When Sir Robert Baden-Powell organized the first Boy Scout troops in England, in 1908, he found, in addition to the thousands of boys who were clamoring to be enrolled, at least 6,000 girls who were interested in the movement. Sir Robert therefore asked his sister, Miss Agnes Baden-Powell, to form an organization for girls similar to the Boy Scouts, to which the name Girl Guides was given. In England the movement went ahead at an amazing pace, and soon spread to Canada, Australia, and many other countries. A flourishing organization also sprang up in France known as Les Éclaireuses.

In March 1912 Miss Juliette Low enrolled in Savannah, Ga., the first patrols of Girl Guides in the United States. In 1915 the name was changed to Girl Scouts at the request of the members; and by this name the organization is also known in Hawaii, Central America, the Philippines, and the West Indies. At present there are in the United States more than 80,000 Girl Scouts and 3,600 captains. The national headquarters are in New York City.

Any girl more than ten years old may become a Girl Scout, and any group of eight girls may organize a Patrol. Several patrols are under the guidance of a captain, who directs the games and various forms of training. For the instruction of the captains national camps and training schools are established. The three grades of membership of the Girl Scouts, which are attained by passing certain tests, are known as Third Class (or Tenderfoot), Second Class, and First Class. The Girl Scout badge is a clover leaf, the three leaves representing her promises: to do her duty to God and her country; to help other people at all times; and to obey the Scout laws. These latter are similar to those of the Boy Scouts, and inculcate truth, loyalty, helpfulness, friendliness, courtesy, kindness, obedience, cheerfulness, purity, and thrift. The motto, "Be Prepared," is also the same in both organizations.

GLACIER. In many high mountains the amount of snow which falls in winter is so great that not all of it is melted in summer. Where this takes place year after year, the amount which accumulates in the upper ends of mountain valleys comes to be very great. These areas where the snow lasts from year to year are known as snow-fields. In the sunny days of summer the surface snow of a snow-field melts, and the water, sinking into the snow, freezes beneath the surface just as it does in the last snow banks of spring and helps to change the snow to ice. The weight of the snow above also compacts the snow below. By the melting and refreezing of the water, and by pressure, the larger part of the snow of a snow-field is changed into ice. Just below the snow at the top the ice is not very compact, but farther below the surface it is solid. A snow-field is therefore really an ice-field, only covered with snow.

When the snow and ice become sufficiently deep, the ice begins to creep down the slope. Ice which has this slow creeping movement down a mountain valley from a snow-field above is a "valley glacier." There are many valley glaciers in the northwestern part of the United States. There are more in Washington than in any other state, but there are a number in western Montana, where an area has been set aside as Glacier National Park. The park has been provided with stopping places, so that it is now easy for travelers to visit the glaciers. There are a few glaciers in the high mountains of Wyoming and Colorado, California, and Oregon. There are many glaciers in the mountains of western Canada, in Alaska, in the Andes Mountains of South America, in the Alps and other high mountains of Europe, as well as in other parts of the world.

There is another great type of glacier, which is not a valley glacier. When the snow and ice accumulate in quantity on a plain or a plateau, it moves out from the center in all directions. This sort of a glacier is an "ice-cap." If it is very large, it is a continental glacier. Some 300,000 or 400,000 square miles of Greenland is covered with such an ice-cap, and the area of ice around the South Pole, in Antarctica, is still larger.

Glaciers move at the rate of a few inches or a few

AT THE FOOT OF A GREAT GLACIER

This man is standing at the foot of a glacier on Mt. Rainier in the state of Washington. The picture shows a stream, formed by the melting of the glacier, running out from under the edge of the ice. Notice the cracks or crevasses that furrow the glacier's surface. In some places such crevasses form a labyrinth of yawning gulfs that baffle the skill and daring of even the best mountaineers.

feet a day. There are perhaps glaciers which move as much as 100 feet a day, but few of them move more than three or four feet. During the movement, the ice is cracked, especially where the ground over which it passes is rough. Thus arise the big cracks or "crevasses" in many glaciers. It is these crevasses which make it difficult and sometimes dangerous to cross glaciers.

As the glacier ice moves, it gathers up a great deal of rock debris and earthy matter from the surface over which it passes and carries it down the valley or towards the edge of the ice-cap. When the glacier melts, it leaves deposits of the debris. This is called "drift." In some cases there is rock debris on glaciers. If it is arranged in belts, the belts are called "moraines."

Formerly there was a huge ice-cap covering a large part of the northern half of North America, an area of some 4,000,000 square miles. Europe had an ice-cap at the same time, perhaps half as large, covering the northwestern part of that continent. The wear of the surface by the ice which passed over it and the deposition of the drift which it carried changed the surface greatly. Most of the lakes of the northern part of North America are due to the ice, which left the hollows in which the water has accumulated. The same is true of northwestern Europe.

GLACIER NATIONAL PARK. "The Alps — right here in the United States!" This is the first cry of the visitor to that mountain wonderland in northern Montana where 60 living glaciers wind in and out among chains of unscaled crags glistening with ice and snow; a place where waterfalls tumble down dizzy precipices, edged by primeval forests; where 250 lakes lie cradled among giant peaks, and where enchanted streams wander through wildflower gardens.

This public park has been called "the roof of North America," for from its mountain heights the waters divide and flow into the Gulf of Mexico, into Hudson Bay, and into the Pacific Ocean. It was once a favorite haunt of the Blackfoot Indians, but when copper was discovered there in 1890 the white man found his way to this home of the mountain sheep, and in 1896 Congress bought it from the Indians. Fourteen years later, since the copper deposits were not large enough to pay for mining, the region was turned into a national park.

Today the wilderness of about 1,450 square miles is dotted with camps, cabins, and here and there even modern hotels; so that the many tourists who flock here each year may either "rough it" or enjoy every up-to-date convenience. (*See* National Parks.)

GLADIATOR. "We who are about to die salute you!" Such was the cry with which the gladiators or professional fighters of the Roman arena saluted the Emperor as they marched about the amphitheater before engaging in combat with one another, or with wild beasts, for the entertainment of the populace. For the most part they were prisoners taken in war, slaves, or the worst classes of criminals. When a gladiator was disabled or disarmed, if the spectators turned up their thumbs the vanquished man was to be spared, but if they turned them down he was to be slain. The successful fighter was at first rewarded with a palm-branch, but in later years it became the custom to add to this rich and valuable presents and a prize of money.

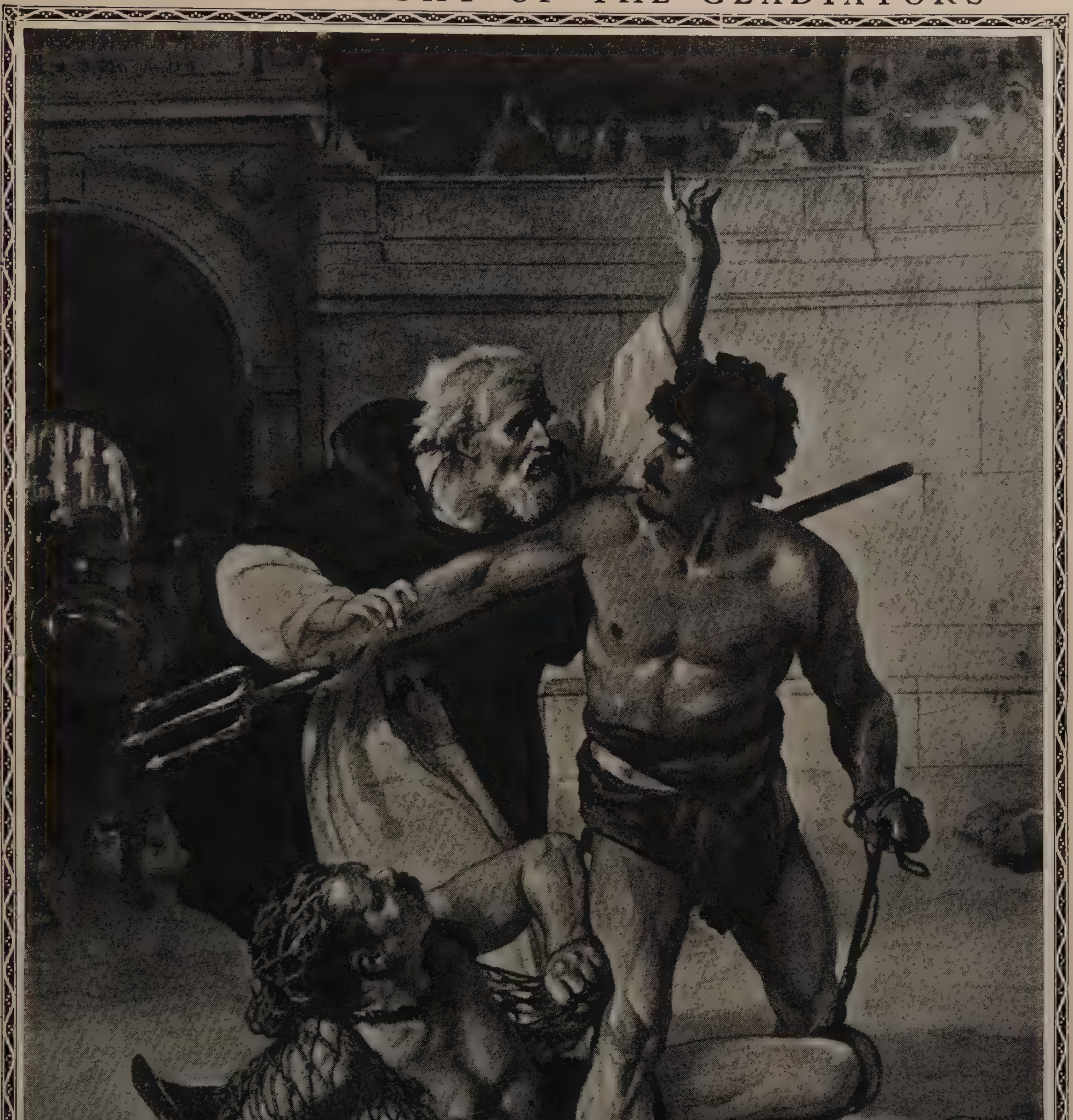
The custom of giving gladiatorial shows seems to have been borrowed from the Etruscans, who sacrificed slaves and prisoners on the tombs of illustrious chieftains. The first combat in Roman history took place in 264 B.C., and the fashion rapidly spread. Julius Caesar gave a show at which 320 couples fought, and the Emperor Titus (79–81 A.D.) gave an exhibition of gladiators, wild beasts, and sea fights which lasted 100 days, in which 10,000 men fought. Such contests were finally stopped in 404 A.D., it is said, as a result of the splendid daring of Telemachus, an Asiatic monk, who rushing into the arena strove to part two gladiators. The spectators stoned him to death, but the Emperor Honorius issued an edict suppressing such exhibitions.

GLADI'OLUS. Stately in form and rich in color, the gladiolus is one of the most effective of autumn flowers. Wonderful results have been secured by scientists in creating new varieties, until there are now about 140 species of this lily-like flower, ranging in color from white and pink, through yellow, apricot, orange, and bronze, to deep rich rose and reds. The flowers grow in spikes and the best varieties are of large size, sometimes measuring 7 to 9 inches across. The plants often reach a height of 4 or 5 feet. The gladiolus belongs to the Iris family (*Iridaceae*), and most of the species are natives of South Africa. The name is the diminutive of the Latin *gladius*, a sword, from the shape of the leaves. "Sword lily" is a name frequently applied to it.

GLADSTONE, WILLIAM EWART (1809–1898). For 60 years William E. Gladstone was a member of the British Parliament. For more than half that time he was the acknowledged leader of the Liberal party. Four times he was called upon to guide the affairs of the British Empire as prime minister, and his name became associated with a great number of political and social reforms. Such a record has been equaled by few men in history, and few have exerted through the force of their characters and personality so profound an influence upon their times as this son of a Scotch merchant.

Gladstone's father conducted a large and thriving mercantile business in Liverpool, and also owned extensive coffee and sugar plantations in the West Indies. Curiously enough, it was the wealth produced on these plantations by slave labor (before the Emancipation Act of 1833) that enabled his son to devote his life to the cause of human liberty. When William was 11 years old he was sent to the famous boys' school of Eton, and from Eton he went to Oxford University, where he was graduated in 1831 with first honors in mathematics and in the Greek and Latin classics. Only once in a generation does a student

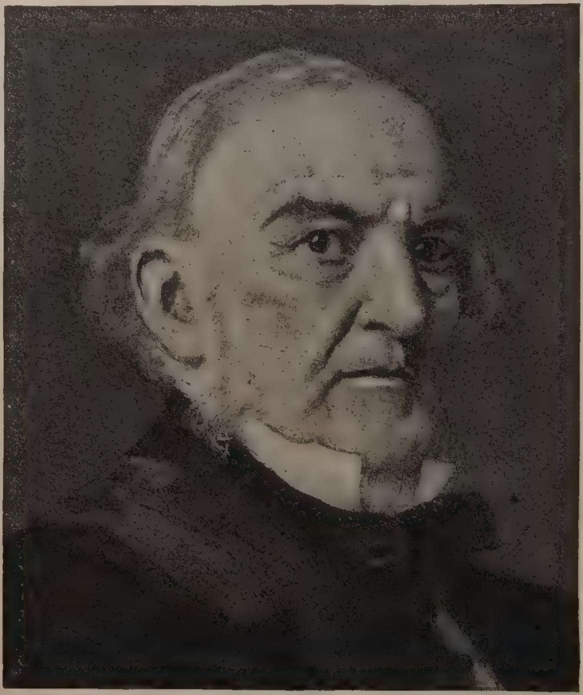
THE LAST FIGHT OF THE GLADIATORS



It was in the year 404 A.D. during the reign of the Emperor Honorius that this thrilling event took place. The gladiator with the trident and the net had just brought down his heavy-armed antagonist and was about to deliver the death blow. The crowd in the Colosseum watched breathlessly for the fatal thrust. Suddenly the aged monk Telemachus leaped into the arena, and in the name of God called upon the victor to stop. Telemachus was stoned to death by the infuriated crowd, but his brave sacrifice had its reward, for the emperor forbade gladiatorial combats from that day on.

win the distinction of a "double first" in these subjects. Deference to his father's wishes led him to give up his own inclination to become a Church of England clergyman, and to enter political life. To the end of his days he retained his interest in theology and in the classics, and in the midst of a busy political career one of his chief diversions was reading Homer in Greek and writing on Homeric subjects and on religion.

Gladstone entered the House of Commons in 1833, at the age of 24. Less than ten years later he became president of the Board of Trade and so a member of the ministry. In the beginning he was so little of a Liberal that Macaulay styled him "the rising hope of the stern unbending Tories." He first abandoned the Tories or Conservatives in 1846, when he supported the Conservative leader Sir Robert Peel against the mass of the Conservatives in repealing the "Corn Laws," so that the people in Ireland might be saved from starving. It was not until 13 years later that he definitely joined the Whig or Liberal party, of which a few years later he became leader.



WILLIAM EWART GLADSTONE
The "Grand Old Man" of British Politics

One of the spectacular feats which first brought Gladstone fame was the defeat he administered in 1852 to Benjamin Disraeli, then chancellor of the exchequer, in a fast and furious debate over the budget. With an eloquence and mastery of details which were almost unprecedented, he tore Disraeli's financial scheme to ribbons. The rivalry between Gladstone and Disraeli, who presently became the official leader of the Conservative party, lasted until Disraeli's death in 1881. (*See* Disraeli, Benjamin.)

In the course of the American Civil War, when so many of the upper classes in Great Britain sympathized with the South, Gladstone became very unpopular with the people of the Northern States because of a public address in 1862 in which he said: "We may have our own opinions about slavery; we may be for or against the South; but there is no doubt that Jefferson Davis and other leaders of the South have made an army; they are making, it appears, a navy; and they have made what is more than either, they have made a nation." This was taken to indicate that the British government, of which he was a prominent member, intended to recognize the independence of the Southern States. Years later Gladstone acknowledged that he had committed an inexcusable blunder in uttering those words. In his first period as prime minister (1868–74), he did much to heal the breach between the United States and Great Britain by agreeing (in 1870) to submit to arbitration the claims of the United States for damages growing out of the *Alabama* affair (*see* 'Alabama' Claims).

It was in his first premiership also that Gladstone began to pass his great measures of internal reform. He secured the passage of a law which for the first time gave state aid to public elementary schools. He opened the universities of Oxford and Cambridge to men of all religions. He introduced secret voting by ballot at the elections, in place of the old public method of voting.

But more than anything else, Gladstone's name is connected with his measures for Ireland. Although most of the people of that island were Catholics, the Anglican or Protestant Episcopal Church was the established church of Ireland, supported by tithes, until Gladstone passed the Irish Disestablishment Act of 1869. He also passed the first Irish Land Act (1870), which removed some of the most serious economic burdens from which the Irish peasants were suffering, and started the process by which most of the Irish tillers of the soil have been changed from rent-paying tenants to owners of the lands. Finally when Gladstone became convinced that the majority of the Irish wanted the Irish parliament restored, he introduced the first Irish Home Rule Bill. This bill (1886) was defeated in the House of Commons by the desertion of a large group of his followers who thenceforth were called Liberal Unionists; and Gladstone was forced to retire as prime minister. When a change in the elections again brought him to that position, he introduced his second Home Rule Bill (1893); this passed the House of Commons but was rejected by the House of Lords. It was then for the first time that the cry was raised to "mend or end" the House of Lords.

Gladstone's political work was now practically closed. In a short time the "Grand Old Man," now in his 85th year, retired from public life on account of approaching blindness due to cataract. His remaining years were spent at his home at Hawarden Castle in Wales. Several times he had been offered a peerage by the Queen, but refused, preferring to remain a commoner. In his long political career he had developed from a Tory to a moderate Conservative, then into a Liberal, and ended as the acknowledged leader of the Radicals. He himself once explained the changes in his political opinions in these words: "I was brought up to distrust and dislike liberty; I learned to believe in it. That is the key to all my changes."

Gladstone was most imposing in his appearance. Six feet tall, with a great breadth of shoulders, and a large head, jet-black hair (in his younger days), deep-set flashing eyes, a prominent nose, and a face of extreme pallor, he seemed to bear down from above upon his opponents. Gladstone used to say that the true secret of his success lay in his faculty of concentrating his mind upon the subject of the moment. This quality he carried even into his life at home. Often even when guests were present he would draw a pocket edition of some classic from his pocket and retire behind the book, becoming utterly unconscious of what was going on around him. Mrs. Gladstone, who had been Miss Catherine Glynne before her marriage in 1830, at times found this habit somewhat embarrassing. Yet during their long married life (Mrs. Gladstone survived her husband by two years) the atmosphere at Hawarden was ideal. One of Gladstone's habits was to sing with his wife when any adversity overtook them:

A ragamuffin husband and a rantipoling wife,
We'll fiddle it and scrape it through the ups and downs of life.

Visitors used to come from all parts of Great Britain to watch the Grand Old Man taking exercise by chopping trees on his estate.

Gladstone served as prime minister from 1868 to 1874; from 1880 to 1885; from February to July, 1886; and from 1892 to 1894. Aside from his fame as a statesman and an orator, he received recognition from his books: 'Studies on Homer' (1858); 'Juventus Mundi' (1869); 'The Irish Question' (1886); 'Gleanings from Past Years' (8 volumes, 1879–90).

GLAND. Every day the human body produces several quarts of liquid. Whenever you cry a liquid called tears flows out between the eyelids. Even if you don't "cry," tears are produced and a drop is distributed over the front of each eye every time you wink. When you are warm a liquid called "sweat" comes out on the skin. All the time there is the liquid called saliva appearing in the mouth. Where do these liquids come from?

The answer is that they are manufactured by organs of the body called "glands." Each gland takes water and other substances out of the blood and from these manufactures its own kind of liquid, which is called a secretion. The "saliva" is the secretion of the salivary glands, located under the tongue and jaw. A tube called a duct leads from each salivary gland into the mouth.

In the wall of the stomach are many small glands which discharge their secretion through short ducts into the stomach cavity. These are called gastric glands and the secretion is called "gastric juice."

Situated near the stomach, and discharging its secretion into the intestine just below the stomach, is the liver, the largest gland in the body. Its juice or secretion is called "bile." There is a pouch, called the gall-bladder, for storing bile. The tube from the gall-bladder to the intestine is the bile duct.

Near the stomach is another large gland called the pancreas or sweetbread. It makes a secretion called "pancreatic juice," which flows through a duct into the intestine.

The Work of the Enzymes

The saliva, gastric juice, pancreatic juice, and bile are all secretions which are useful in the digestion of food. They contain substances, called ferments or "enzymes," which change complex foods into simpler substances. The saliva by means of an enzyme called "ptyalin" splits starch molecules into sugar molecules. Each digestive secretion contains its own peculiar enzymes, designed to aid in digesting particular kinds of foods.

The mammary gland secretes milk, which is not intended for the individual that produces it but for its offspring. Therefore the ducts of this gland lead to the surface of the body. This secretion contains all the food substances that the young animal will need during its infancy.

The kidneys also may be looked upon as glands. They manufacture from the blood a secretion called "urine." But in this case the liquid is composed of waste materials and is thrown out of the body. Consequently the process is generally called "excretion," instead of "secretion."

All the glands mentioned so far have ducts by which their secretion is carried either to the outside of the body or into the alimentary canal. But there are in the body certain "ductless" glands. The secretions they produce find their way into the blood and are carried all over the body. These secretions are called internal secretions or "hormones."

Among the ductless glands may be mentioned the thyroid, the parathyroid, the suprarenal, and the pituitary. The uses of all these are imperfectly understood, but it is known that they influence the activity of organs distant from themselves in the body. This is done through the circulating blood, as already stated.

The Importance of the Thyroid

The thyroid gland is located in the neck. It is known that the secretion of this gland has a wonderful influence on the utilization of food by the body. If a baby has too little thyroid secretion, it does not grow properly but becomes a peculiar idiotic dwarf known as a "cretin." In adults the lack of thyroid secretion leads to a disease called "myxedema." Too much thyroid is as bad as too little and causes a disease known as "exophthalmic goiter."

The secretion of the thyroid gland contains a substance called "thyroxin," which is a complex chemical containing iodine. The suprarenals located above the kidneys secrete a substance called "adrenalin" which keeps the blood-vessels in the right condition. Thyroxin and adrenalin are examples of the class of substances called hormones.

The pituitary is located below the brain. It is derived in early stages of development partly from the nervous system and partly from the pharynx. Owing to this fact it has a double function. It has much to do with the proper growth of the young. It also affects muscles and some glands. Particularly it increases the secretion of urine and of milk.

The parathyroids are imbedded in the thyroid, but are distinct in function, having to do with the growth of bones. In general, the ductless glands are essential to the body. Removal of the pituitary, suprarenals, or parathyroids causes death in a few days.

Gland therapy has become a vital part of medical science. The discovery in 1923 of "insulin" by Dr. F. G. Banting of the University of Toronto is an outstanding achievement in this field. Insulin is a substance secreted by the pancreas, independently of the pancreatic juice. It regulates the use of sugar by the body. Insufficient insulin causes the disease called "diabetes mellitus." By injecting into diabetic persons minute doses of insulin obtained from the pancreas of animals, the course of this deadly disease is arrested.

Glasgow, Scotland. Smoke from the giant chimneys of scores of factories; a deafening clatter from thousands of hammers pounding on cold steel; miles of shipyards lining each side of the river with forests of masts, acres of hulls, and skeletons of many vessels; and, winding in and out among nine miles of quays and docks, steamers old and new flying the flags of every nation! This is Glasgow, Scotland's industrial and maritime metropolis, which is not only one of the greatest manufacturing cities but also the shipbuilding center of the world.

THE PARTNERSHIP OF GLASGOW AND THE CLYDE

It has been said that "Glasgow made the Clyde and the Clyde made Glasgow," and this is largely true. The city made the river into a great harbor, and the harbor is the key to Glasgow's present greatness. This view shows a section of the busy river-front.

"Glasgow made the Clyde and the Clyde made Glasgow" is one of the true sayings of this city. Many years ago Glasgow was only a small marshy village, but the people determined to have a port. They began to deepen, widen, and wall in their River Clyde which was then only three feet deep. The city today—which, next to London, is the largest in Great Britain—has a fine artificial harbor, costing over $40,000,000.

With its excellent connections by road, rail, and water, this commercial capital of Scotland—built right in the midst of great iron and coal fields—makes good use of its opportunities. Besides shipbuilding, and the building of all kinds of machinery, the city has important cotton mills, textile factories, calico printing and dyeing works, and distilling establishments. And its chief exports are cotton, linen, and woolen goods, machinery, coal, chemicals, paper, and whiskey. Glasgow is also the starting point for tourists who wish to visit the western Highlands. Here one finds some of the finest scenery of the British Isles, including Ben Nevis, Ben Lomond, the Trossachs, Loch Lomond, and Loch Katrine, the scene of Scott's poem 'The Lady of the Lake'.

The old part of Glasgow slopes down to the river—here called the Broomielaw—and the new part is on the higher background. Glasgow is known as one of the world's best governed municipalities. The various city improvements and undertakings are carried out by a corporation which divides itself up into a series of "trusts" with subcommittees that supervise the different departments of city administration. There are Market Trusts, Police Trusts, Improvement Trusts, etc. Glasgow's system of municipal ownership of public utilities has proved to be very efficient and economical.

Although rather dingy and smoky in appearance, Glasgow has many splendid buildings, most of them of recent erection. Its cathedral (St. Mungo's) built between 1197 and 1446, is a beautiful example of early English architecture. The massive modern buildings of the University of Glasgow (founded 1451) occupy a commanding position in the handsomest part of the city. The world-famous municipal art gallery contains the finest collection of paintings in Great Britain outside of London, including Whistler's portrait of Carlyle. Population, about 1,035,000.

The MAGIC ART *of the* GLASS-MAKER

A Striking Example of the Chemist's Achievements and of the Mysterious Transformations Wrought by Fire—The Work of the Blower with His Big Glass Bubble

GLASS. No one knows just where or when men first found out how to make glass, but the story told by Pliny the Elder suggests how the discovery *may* have been made. In long forgotten days, according to this Roman naturalist's account, the crew of a Phoenician ship voyaging from Egypt to Syria had built a camp fire on a sandy beach of Palestine, near Mount Carmel. To prop their cooking pots they took from the ship's cargo pieces of natron, a crude form of soda, used in those days in embalming the dead. Lo! next morning in the ashes they found shapeless lumps of glass, formed by the fusing of the sand and the soda. This at least is certain, that the Egyptians and other ancient peoples had learned to manufacture vases, cups, and beads of glass at least 4,000 years ago.

In modern glass factories, the mixture is melted either in special fire-clay crucibles for the finer grades, or in large tanks built of fire-clay slabs. These tanks are rarely more than three feet deep, but are often of great extent, holding 200 tons or more of the mixture at a time. The walls of the surrounding furnace are built of nearly pure silica, for even fire-clay cannot withstand the terrific heat which is necessary to produce glass.

THE STRANGE OBJECT THE PHOENICIAN COOK PRODUCED

Of all the strange things that cooks have turned out in the course of time, none, it is safe to say, is more remarkable than the little lump of glass that, according to the old story, those Phoenician sailors found under their cooking pot on the sands. Not even Aladdin with his wonderful lamp ever produced anything half so amazing as the great industry that grew from finding this sparkling lump.

Just before the mixture of finely ground sand, soda, lime, or other ingredients is put into the crucibles or the tank, a mass of broken glass called "cullet" is added to speed the fusion. As the melting proceeds, the mixture foams and bubbles until it becomes as liquid as water. Impurities are skimmed off the surface, the mixture is allowed to cool until it is "sticky," and the work of blowing or molding begins.

Many of the larger glass factories do all the actual molding and blowing by machinery, but some of the old "mouth-blowing" still persists. Suppose the task in hand is blowing window glass. The "gatherer" dips the bell-shaped end of a five-foot blowpipe into the "soup," as he calls it, and a small ball of glass sticks to it. He puts his mouth to the other end and blows, forming a thick-skinned bubble. He dips this into the molten glass again, and blows the bubble bigger. Four or five times this is repeated, until the soft bubble has grown as big and heavy as a watermelon.

Now the pipe with its bubble passes to the "blower" who is the real expert. He puts the bubble in a molding block, and alternately blows and turns until it becomes long and pear-shaped. When the glass becomes too cold to expand readily, it is reheated in a blow furnace. Then the blower mounts a bridge built across a deep "swing hole." He swings the pipe with its hanging mass of glass back and forth, blowing all the while, until it is drawn out into a long cylinder with thin even sides. When this has cooled the ends are cut off by wrapping a hot glass thread around them and touching this with a cold iron. Immediately a crack runs around the cylinder in the path of the thread.

The open cylinder is now laid in a cradle; a hot iron is drawn down one side in a straight line; a cold iron touches this line; and the cylinder is split lengthwise as neatly as you would cut a sheet of paper with scissors. Finally the sheet is heated and flattened, and stored to be cut into window panes.

The compressed-air machine blowers perform the same tasks as the mouth blower, but they handle much larger quantities of glass and produce much longer and broader cylinders. Bottles are now generally blown into molds by automatic machines, some of which turn out 50,000 a day.

In making plate glass, the molten glass is dipped up from the tanks in big pots attached to cranes and poured out upon large iron tables, which have adjustable rims as high as the desired thickness of the glass. There it is rolled out smooth, like dough under a rolling pin. The coarser grade, used in skylights, is then ready for final cooling. The finer grades, for shop windows, mirrors, etc., are carefully ground under iron blocks, then polished with felt and a powdered oxide of iron called "rouge." Thus glass is obtained which is uniform in thickness and does not distort the view as does ordinary window glass.

The "blanks" from which cut-glass articles are made are first pressed into shape in molds. The patterns are then marked on with chalk, ground out with sand and emery wheels, and the ground surfaces polished with putty powder. In the cheaper grades, the pattern is pressed into the glass in the original mold. The edges are then ground sharp and the surfaces polished until it is almost impossible to distinguish between the two grades either in their appearance or quality.

"Wire" and "Frosted" Glass

"Wire glass" is made like plate glass, except that the heated wire screen is pressed into the middle of it while the glass is still soft. "Ground" and "frosted" glass is produced by making one of the surfaces rough, so that, although light passes through, it is so diffused that the details of objects are not visible. Glass is "etched" by being covered with a thin coating of wax, through which a pattern is scratched; hydrofluoric acid, one of the few chemicals which will actively attack glass, is then allowed to eat through the places where the wax is scratched away.

Though glass appears under most conditions very rigid and brittle, it can be drawn into strands almost as fine as a spider's thread and nearly as flexible as silk. Such "spun glass" is usually made by melting the end of a glass rod; drawing out a thread from it as you would draw taffy; and fastening the end of this thread to the rim of a large wheel. While the rod is held in the flame to keep the glass soft, the wheel is revolved rapidly, drawing out the fine thread and winding it up at the same time. The bright golden hair of many of the best china dolls is spun glass; and cloth can be woven from it. "Mineral wool" is a similar form of glass fiber produced by turning compressed air or steam upon molten glass. It is used as a heat preserver around boilers and steam pipes, as a filter in chemical operations, and as a polishing fiber for gold and silver.

Clear and Colored Glass

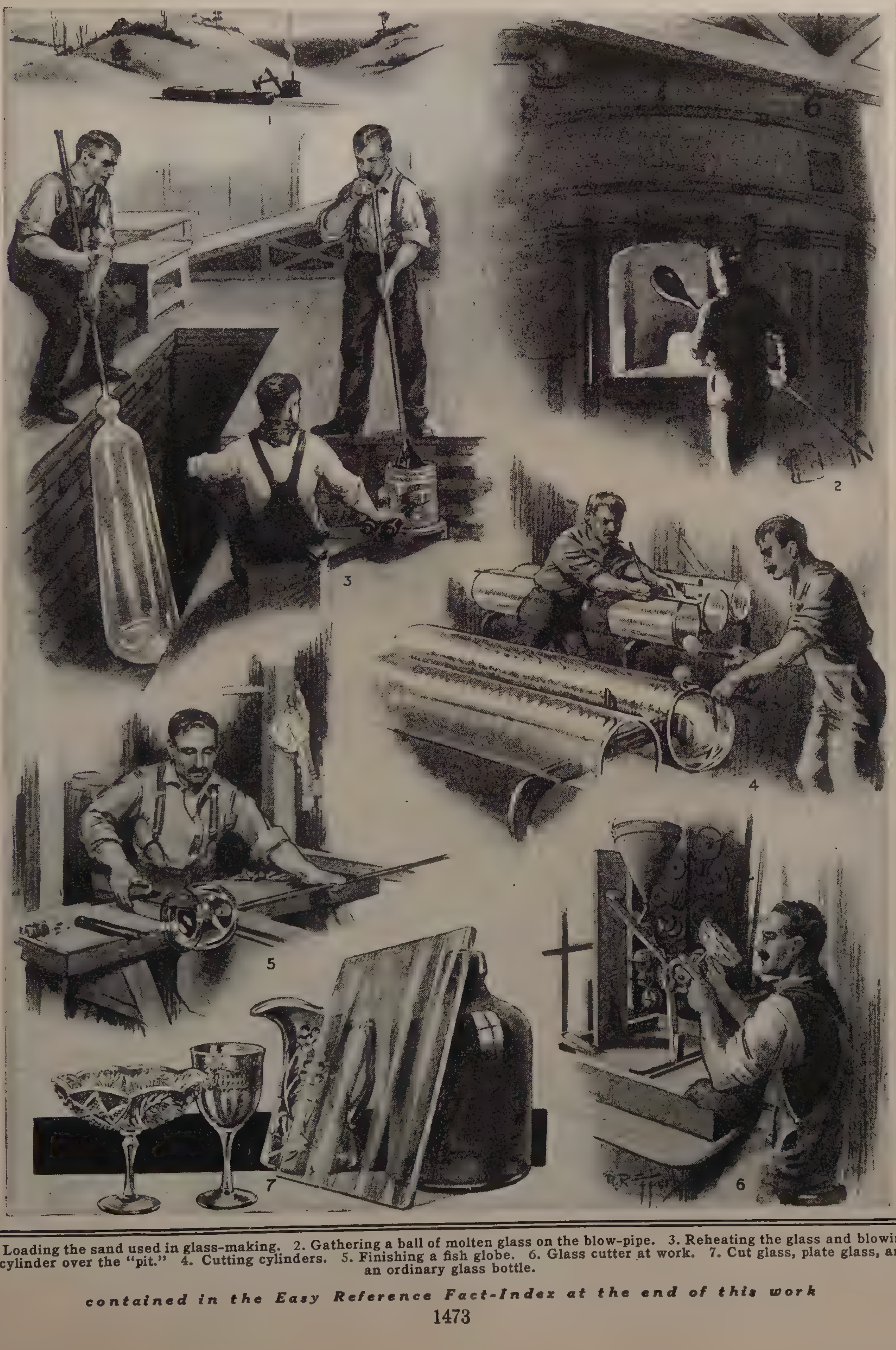
Colored glass is made by adding small amounts of various metallic oxides to the usual material. Chromium gives green shades, manganese shades from pink to purple; copper yields reds and blacks; uranium, yellows and greens; cobalt, a great variety of blues. The best "ruby" glass is made by adding a tiny quantity of gold, which is held in suspension in the form of a powder so fine that it can be seen only with the ultra-microscope. To reduce the expense only a thin coating of ruby glass usually is applied to the surface of a sheet of clear glass.

Even plain clear glass varies greatly in its composition, and its properties depend upon the "base" chosen to mix with the silicate, as well as upon the treatment it receives in the making. For example, lead and barium give weight and brilliancy and increase the softness during the manufacture. Magnesium and aluminum give a glass which stands red heat without softening. "Crown glass," which contains soda, has a very brilliant surface; it derives its name from the process of blowing. "Flint glass," also called "crystal glass," contained lead, but received its name from the fact that its silica was obtained from powdered flints; the term is now applied to almost any transparent colorless glass.

The most difficult tasks of the maker of fine glass are, first, to obtain pure chemicals and mix them in the proper proportions, and second, to temper or anneal his glass properly, when it is cooling. Glass mixtures are extraordinarily sensitive to changes in chemical composition. A minute quantity of iron, for instance, in a big "batch" of plate glass may discolor it all, and once the mixture is melted, there is no way of removing the offending chemicals; the whole mass must be thrown away or used for some inferior purpose. Or perhaps the maker of "flint" glass has put in an extra quantity of the lead oxide which gives it its brilliancy, and several months later the cut glass bowl he has fashioned tarnishes to a dull and dirty hue.

Even if the mixture is exactly right and the article is blown or molded to its proper shape, the whole may be spoiled by allowing it to cool too quickly. Glass as you know is an extremely poor conductor of heat, and when boiling water is poured in a tumbler it cracks. This is because the inside gets hot and expands quickly while the outside remains cold and contracted. Some

SCENES IN THE STORY OF GLASS-MAKING



1. Loading the sand used in glass-making. 2. Gathering a ball of molten glass on the blow-pipe. 3. Reheating the glass and blowing a cylinder over the "pit." 4. Cutting cylinders. 5. Finishing a fish globe. 6. Glass cutter at work. 7. Cut glass, plate glass, and an ordinary glass bottle.

fine grades of glass are cooled over a period of many weeks to give them the proper temper. Certain "low expansion" glasses have been produced which may be plunged while almost red hot into cold water without cracking. These are valuable for baking dishes, chemical apparatus, water-gages in steam boilers, and many other purposes.

It is in making the high grades of optical glass that the most careful science is called into play. Certain chemicals, principally compounds of barium, boron, magnesium, lithium, and phosphorus, when added to the ordinary ingredients alter profoundly the effect of the glass upon the light rays that pass through it. For generations scientists who used microscopes, telescopes, photographic apparatus, etc., had been handicapped by the optical defects of lenses made with ordinary flint and crown glass. In 1881, however, two physicists began in the city of Jena, Germany, a series of experiments which resulted in the production of about 2,000 new kinds of glass, more than 70 of which have proved of immense value in lens-making. The others are prized for their colors, their toughness, their resistance to heat, etc. During the World War, when the supply of Jena optical glass was cut off, other countries, including the United States, made great strides in the domestic production of optical glass for telescopes, field glasses, periscopes, and similar instruments. France outstripped all other countries in the making of artistic glassware. American inventors have developed the mechanical side of the industry, producing machinery which greatly aids the manufacture. Pennsylvania leads in the United States in the production of glass for general purposes. Next in rank are Ohio, Indiana, West Virginia, Illinois, New Jersey, and New York. Cheap fuel (especially natural gas) and a plentiful supply of the right kind of sand near at hand are essential for a successful glass factory.

GLASS AND SUBMARINE BOTANY

One of the most interesting uses of glass is in making museum models of plants. This picture shows a group of sea plants in the New York State Museum at Albany. Glass is used because it can be made to reproduce exactly the translucent colors of marine vegetation.

Not the least of the glories of the Gothic cathedrals with which the Middle Ages enriched Europe were the vast stained glass windows whose storied radiance flooded the dark interiors with brilliant color. In large part the art which produced them is now lost to the world, though America has made some notable progress in its revival.

In producing such a pictured window, the artist worked out his design by means of a "mosaic" of bits of colored glass set in outlines of lead. The delicate shadings of draperies, the lines of the figures, etc., were produced by painting the surfaces with colors made from metallic oxides mixed with oil of turpentine. Finally the colors were fixed by firing—that is, the glass was placed in an oven, and the pigments were fused into the glass by heat, so that the coloring was made both transparent and permanent.

From Egypt the knowledge of glass-making spread to neighboring lands of the Mediterranean. It was introduced among the Romans about the beginning of the empire though glass had long been imported. As the art declined in Rome with the decay of the empire, it was transferred to Constantinople, where it flourished during the Middle Ages. The Arabs obtained a knowledge of glass-making, and the glass of Damascus was widely celebrated. Venetian glass also early became famous, and mirrors, goblets, and cups from Venice were sent all over the known world. The first attempt at the manufacture in the United States was at Jamestown, Va., in 1608.

GLOVES. Kid, silk, lisle, and cashmere gloves for dress and leisure wear; buckskin and dogskin for riding, driving, and heavy uses; rubber gloves for surgery, electrical work, and housework; cheap cloth gloves for any rough task—there are gloves for every use and every occasion. But the two main classes are leather and fabric gloves.

Leather gloves are made of skins of deer, sheep, lamb, goats, and kids, but the name of the glove does not always tell the animal from which it came. While French kid is considered the finest glove material, more "kid," "doeskin," and "buckskin" gloves are made of lambskin than of kidskin or deerskin. "Chamois" gloves, too, are made from the inner layer of split sheepskin or lambskin, tanned with fish oil to make the material washable. The so-called English "dogskin" or "Cape" gloves are made from the skins of sheep grown at the Cape of Good Hope; American tanners, improving on the English process, make washable Cape leather. "Mocha" gloves are made from Arabian sheepskins, first shipped, it is said, from the port of Mocha which gives its name to Mocha coffee. The mocha finish, producing a leather much like "suède" or undressed kid in appearance, but stronger, is an American invention; it is produced by "buffing" or "friezing" the smooth surface from the hair side, whereas suède is finished on the flesh side. It should be noted that the finest grades of wool usually grow on skins which are much inferior to those which produce heavy wiry wool. The best skins for gloves used to come from Russia; other varying grades come from Spain and eastern Europe.

The dried skins, when received, are soaked and softened in limewater for two or three weeks, cleaned of hair and flesh, cured by the process necessary for the particular kind of glove desired—for example, skins for kid gloves are "tawed" in a custard of alum, eggs, flour, and salt—dyed, and given the desired finish. The "glacé" finish is produced by sizing the grain or hair side.

The prepared skins are next divided into "tranks" or slips, and each trank is cut by machine-operated dies into a glove ready for sewing, the scraps being used in making the strips for the inner sides of the fingers, etc. Fine dress gloves are sewed over and over ("overseam" or "roundseam"); heavier walking gloves may have one edge lapped over the other (*pique*); very heavy gloves have the edges brought together like an overseam but are sewn through and through ("prickseam" or "saddlers' seam"). Machines for sewing gloves were invented scarcely 50 years ago; though they were long fought by many of the best manufacturers, most gloves on the market are now machine sewn.

Fabric gloves may be made of silk, lisle, cotton, or cashmere or other wool yarn. They may be knitted without seams, or stamped out of a fabric knitted with a special stitch which does not ravel when cut. They are cut and sewed somewhat as are leather gloves, but in larger sizes, being shrunk to the proper size after cutting. Knitted gloves and mittens are made in a number of hosiery mills.

In spite of the introduction of machinery, leather glove-making continues to be a highly skilled occupation, which thrives best in communities long devoted to it. French gloves have long had a high reputation, and the finest French gloves have come for centuries from Grenoble, Paris, Niort, and Vendôme. Copenhagen and Brussels are other continental glove-making centers. The great English glove center is Worcester. In the United States the industry is carried on chiefly in Fulton County, N.Y., especially in the towns of Gloversville and Johnstown, where it has existed since Sir William Johnson in 1760 brought over some glovemakers from Perthshire, Scotland (the "Fair Maid of Perth," you remember, was a glover's daughter). Although the importance of the industry and the production of fine gloves are of comparatively recent date in the United States, gloves of the finest quality are now made.

GLOWWORM. A beetle native to Europe, the female of which is wingless, somewhat wormlike, and possesses a "lantern" on its abdomen with which it signals to the flying male. It is rarely found in America, but is a widespread European and Siberian insect. (*See* Fireflies and Glowworms.)

GLUCOSE. Out of every 100 pounds of the whole corn crop of the United States, one pound is converted into glucose, or "corn syrup." Glucose is a very thick liquid, usually light amber in color, and about two-thirds as sweet as sugar cane syrup. Many plants transform starch into glucose, and honey consists largely of glucose which the bees have collected.

Since glucose does not readily crystallize, it is especially useful in preserving and canning. Cheaper grades of candies are nearly all glucose, and even the best grades usually contain a certain percentage of glucose to keep the sugar from graining. Mixed with about 15 per cent of cane syrup it is widely used for the table. Scientists once argued over the wholesomeness of glucose, but food experts of the government have repeatedly declared that it is in no way injurious to health. It requires practically no digestion, being absorbed by the blood directly from the intestines, and is then burned by the tissues to furnish heat and energy.

Glucose is made by treating starch with very dilute sulphuric acid. The starch is said to be "hydrolyzed" and is converted chiefly into glucose. Chalk or caustic soda is added to remove the acid, and the liquid is filtered, decolorized by passing through bone-black, and evaporated in vacuum-pans to the desired consistency. If the evaporation is continued until a great deal of the water is eliminated, the product is chiefly *grape-sugar* or *dextrose,* a mass of tiny white crystals surrounded by syrup. (*See* Sugar.)

GLUE. In making glue the hoofs, horns, bones, and sinews of animals are crushed and the fat is extracted with hot naphtha. The materials are then boiled in water under steam pressure until the glue, which is an impure gelatin, oozes out. This is clarified with potassium alum, concentrated in vacuum pans at low temperatures, bleached with sulphur dioxide, and run into pans to "set." It is then cut into thin slices and dried. Some glue is prepared from clippings of hides which are steeped in lime to remove the hair and blood, washed and dried, and then boiled with water. Fish glue is a very strong and bad-smelling adhesive made from fish skins, bladders, and other fish offals.

Glue is prepared for use by melting in pots set in hot water. Liquid glue is kept fluid by adding an acid. Elastic glue, used in making printers' rollers and for other purposes, contains glycerin. The sizing which paper-hangers put on plastering before pasting on wall paper is a thin solution of glue and water.

The glue industry in the United States was founded by Peter Cooper in 1827. Today most glue factories are operated in connection with meat-packing houses.

GLYCERIN. A chemist would call glycerin (or glycerol, as he terms it) a tri-hydric alcohol; but in spite of this formidable name it is a very common and a very useful substance, without intoxicating properties. It is found combined with fatty acids in all true fats and oils (not mineral oils). It is found free in palm oil, and as it is a product of alcoholic fermentation of sugar it occurs in such fermented liquors as wine and beer, although to a slight extent. Much glycerin is obtained as a by-product in the manufacture of soap (*see* Soap). The fat or oil is treated with alkali, and the products are soap and glycerin. The glycerin is then distilled off and further purified. If beef fat or other fat rich in stearin (a combination of glycerin and stearic acid) is treated with superheated steam, the stearin is split into glycerin and free stearic acid, a hard waxy substance which is mixed with paraffin to make candles.

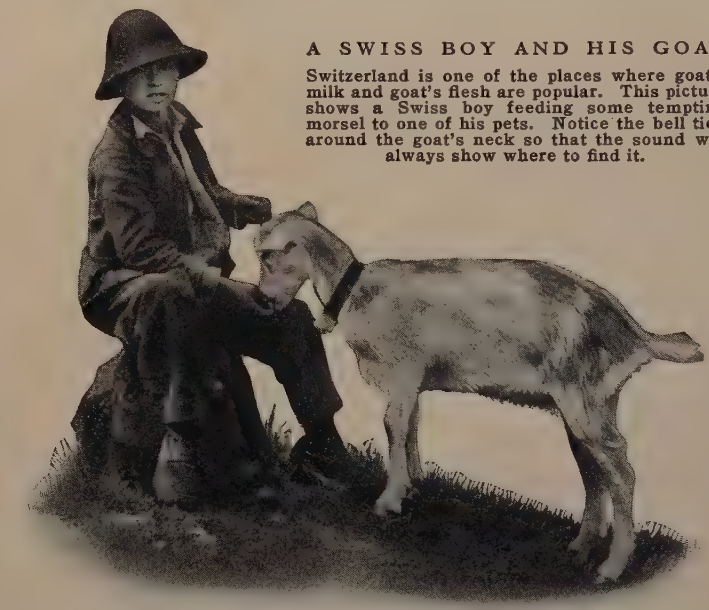
Pure glycerin is a colorless odorless syrup. It is very sweet (hence the name, from the Greek *glykys*, "sweet"); it is heavier than water, and will mix in all proportions with water, and yet it will burn. Glycerin will dissolve many substances and large quantities are used in toilet preparations, such as soaps, face creams, and washes. It is also used in gas meters and other mechanical appliances in which a liquid is needed which will not readily freeze at winter temperatures or evaporate in summer.

The largest use of glycerin, however, is for making nitroglycerin, dynamite, blasting gelatin, and smokeless powders. The great scarcity of fats in Germany during the World War was largely due to the amount of fats used for the manufacture of these explosives for military purposes.

GNAT. Any of the very small two-winged insects are commonly called gnats, but the name is not a scientific term. Some of the insects which are called gnats are the smaller mosquitoes, midges, buffalo gnats, and gall gnats. The true mosquitoes can be told by the fringelike scales on their wings, and because their young always grow in the water.

GOAT. Though the name of the useful goat has long been a synonym for evil, it is far from deserving its ill reputation. No domestic animal is more widely distributed and none has been of greater service to man. It gives edible nutritious meat and wholesome milk; fine leather is made from its hide, and an exceptionally strong durable cloth from its hair; and, most important of all, it is extremely hardy and can grow fat on coarse vegetation on which other animals would starve. Part of the goat's evil reputation doubtless comes from the strong odor and surly temper of the males, and from the frequently acrid taste of the flesh and milk. In America it is little used for food, but some people prefer its milk and flesh to that of the cow.

Goats are closely allied to sheep, but are distinguished by the beard on the chin of the males. Wild goats are found only in Europe, northern Africa, and the Himalaya Mountains. Of the ten species the ibex is the most interesting (*see* Ibex). The Rocky Mountain goat of North America is an antelope and not a goat (*see* Antelope).



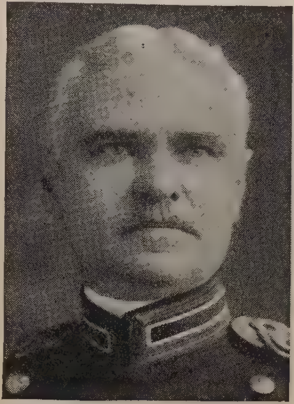
A SWISS BOY AND HIS GOAT

Switzerland is one of the places where goat's milk and goat's flesh are popular. This picture shows a Swiss boy feeding some tempting morsel to one of his pets. Notice the bell tied around the goat's neck so that the sound will always show where to find it.

Domesticated goats (*Capra hircvs*), which are thought to be descended from the wild goat of Persia, have been bred in many parts of the world from the earliest times. The Angora goat, native to Angora, in Asia Minor, has a history that may be traced back to the days of Abraham. This type has long spiral horns, and an abundance of long white silky hair, from which a strong cloth is made, called mohair. It is extensively bred in Turkey, South Africa, and to a smaller extent in the United States. Brushwood forms one of its favorite articles of diet and so herds of Angoras are much used for clearing brushland. The flesh of this species is edible at all ages and is often sold as mutton.

Milch goats are found in all European and Asiatic countries, the Toggenburg and Saanen breeds of Switzerland being the best. Because of the wholesomeness of goat's milk, especially for invalids and sickly children, the number of milch goats in the United States has greatly increased. When its size is considered, a good goat is a larger producer of milk than the cow, and it costs much less to keep one. It is for the latter reason that the goat is sometimes styled "the poor man's cow." The highly prized Swiss cheese is made from goat's milk.

Cashmere (India) and Tibet are the home of the Cashmere goat, from whose beautifully soft silky under-coat are made the famous Cashmere shawls. Attempts to introduce this breed in the United States have been unsuccessful. These Cashmere shawls are exceedingly costly, for it takes the fleece of ten goats to make one shawl a yard and a half square, and the weaving, which is all done by hand, takes about a year. Some especially beautiful patterns have been sold for as much as $1,500.


GEORGE W. GOETHALS
Master Engineer of the Panama Canal.

The hides of young kids are used extensively for gloves and shoes, though much of the so-called kid-leather is an imitation, made from the skins of rats and dogs. The skin of the Angora, with the hair intact, is often used for rugs and robes. Goat-skins are also used in the manufacture of shoes, music rolls, morocco for book bindings, and other articles. So great is the demand that more than $30,000,000 worth are imported into the United States every year.

GOETHALS (*gō'thăls*), GEN. GEORGE WASHINGTON (1858–). Imagine yourself in jungle-clad Panama during the construction of Uncle Sam's canal. It is only 7:00 a.m., but Colonel Goethals of the United States Army, appointed "boss of the big job" in 1907, is already off in a little yellow car, called by the canal workmen the "brain wagon." Tall and gray, with bronzed face and blue eyes, he drops off now and then to watch men digging or blasting. A word here, a question there, and on he goes, "always on the job."

The direction of the greatest engineering task in history required not only a master engineer, but a true organizer and commander of men. With a genius for detail, Colonel Goethals organized the labor army of 40,000 into a model of smooth-running efficiency and industrial contentment. Though he was equipped with the power of a Russian czar, no humble dark-skinned laborer but could go to him personally. A man of force and resources, strong in personality and able to inspire confidence and energy in others, he brought the canal to completion in 1914, nearly a year ahead of schedule.

"Peace hath her victories, no less renowned than war." Goethals proved himself a hero-soldier of peace. Indeed, his peace victory in Panama was even vaster in its effect on the destiny of nations than many a military triumph.

Experience had fitted him for the great undertaking. Born in Brooklyn, N.Y., he was graduated from West Point in 1880, second in his class. His rise in the army through the lower grades was slow, but he was made captain in 1891. He taught military engineering at West Point (1885–87); was chief engineer of volunteers in the Spanish-American War (1898); was for a time a member of the Board of Fortifications; and had taken the advanced course in the War College (1905) before his engineering opportunity came at Panama.

After the completion of the canal Goethals was made major-general and appointed first civil governor of the Canal Zone (1914–16). After the United States entered the World War he was made acting quartermaster-general of the army, and filled many other posts of importance in that trying time. After retiring from the army in 1919 he became a member of an engineering firm to engage in reconstruction work in America and Europe. Princeton University and the University of Pennsylvania both honored him with the degree LL.D. In addition to special thanks from Congress for his work in Panama and the Distinguished Service Medal for his services in the Quartermasters' Department, the French government made him a commander in the Legion of Honor. (*See* Panama Canal.)

GOETHE (*gû'tĕ*), JOHANN WOLFGANG (1749–1832). Goethe, the great German poet, once said that he "lived" his poems and that they made up "a great confession." He meant that he found life so interesting, and even small happenings so full of meaning that when he had caught the secret of the interest or had come to understand the meaning, his joy or sorrow had turned into something that became a poem or a story. His zest for life and his lively imagination he inherited from his mother. She was only 18 when he was born and she once said, "My Wolf and I were children together." From his father, however, he inherited a certain sedateness and steadiness. So he was always making the most of life and getting the most out of it, yet never letting himself go or losing his grip on himself. He seemed always to find the golden mean in life. Thus in what he wrote there is a great deal of wisdom as well as beauty and charm.

Goethe's greatest work, 'Faust', a dramatic poem in two parts, is in a special sense the "confession" of his whole life. From early youth, when he learned the story of Dr. Faustus from a puppet play, until he penned the last scene shortly before his death, there was scarcely a period of his life that Faust was entirely out of his mind, scarcely a period that did not add something to the great work that was growing under the poet's hands. Faust desires all knowledge, to squeeze the lemon of life dry. Unsatisfied by the results of his studies, he turns to magic. He conjures up the devil in the shape of Mephistopheles and makes an agreement with him. In Goethe's 'Faust', Mephistopheles must gratify Faust's every wish; if he can satisfy Faust, Faust's soul is to belong to Mephistopheles. Faust learns that pleasures are not happiness. His wishes become purer and reach their highest point in a grand project that is to benefit others. The moral height he has reached calls the powers of Heaven to his aid and in response they wrest his soul from the clutches of Mephistopheles. (*See* Faust Legends.)

Goethe's other great work was his novel 'Wilhelm Meister'. This work, too, Goethe wrote at various times, changing the plan from time to time. But through it all Wilhelm Meister is seeing life and learning in the school of experience. Life is the best teacher, Goethe thought. He wanted the fulness of life for himself, and he tried to show others how to live fully.

THE BIRTHPLACE OF GENIUS

In this picturesque house in Frankfort-on-the-Main, Goethe was born in 1749, and here he spent his boyhood. Frankfort was a progressive city and stimulated the genius of its most famous son.

Goethe's long life was, indeed, a full life. His boyhood was spent in Frankfort-on-the-Main, which was in the cross-currents of the history that was then making. A boy like Goethe could not help but be stirred by the happenings around him, even though they did not directly affect the course of his life. He was taught at home by his father, together with his only sister Cornelia, a child scarcely less gifted than himself. Both excelled in literary exercises. Wolfgang wrote his first dramas for a puppet theater which his grandmother had given him.

From Frankfort he went to the University of Leipzig and from there to the University of Strasbourg. At Strasbourg he met the critic Herder, who directed his attention to Shakespeare and to folk poetry (the ballads and songs that seem to have no author and live only in the recitation and singing of the common people). Such literature offered more naturalness and warmth and real life than was to be found in 18th-century poetry. The songs Goethe now wrote were indeed marked by greater naturalness and truth to life, and made the beginning of a new and great era in German literature. His first drama of note, 'Goetz von Berlichingen with the Iron Hand', is the story of a staunch but lawless baron of the 16th century, and shows the influence of Shakespeare. A translation of it influenced Sir Walter Scott to write 'Marmion' and 'The Lady of the Lake', "with all that followed from the same creative hand." Many others were similarly influenced.

Goethe won the friendship of the Duke of Saxe-Weimar, a ruling prince of Germany, who made him a councilor of state at Weimar. Goethe took his duties seriously. He gave particular attention to developing the agriculture, forestry, and mining of the duchy, and thus began his studies in the natural sciences, in the course of which he foreshadowed the Darwinian theory of evolution. Later he was, for 22 years, the director of the duke's court theater. Other great men were also attracted to Weimar, notably Herder, Wieland, and Schiller, and Weimar thus became the intellectual center of Germany.

In 1786–88 Goethe made a journey to Italy, drawn there by his interest in Greek and Roman art. He himself regarded this first visit to Italy as the turning point in his life. He saw that the "natural" expression in poetry had gone too far (though he had not carried it too far in his own works), and his experience in Italy gave him a broader and sounder view of literature, art, and life. Goethe might always be trusted to find something to steady him, even in circumstances that swept others off their feet. The Greek spirit of measured beauty is found in Goethe's play 'Iphigenie at Tauris', and in the delightful little epic of 'Hermann and Dorothea'.

Goethe's friendship with Schiller, the best loved of German poets, is one of the famous literary friendships of history. It was helpful to both. It gave Goethe new inspiration, and a surer guidance to Schiller's somewhat too impetuous genius. The death of Schiller in 1805 was deeply mourned by Goethe. The friendship is commemorated in Weimar by a statue of the two poets standing with hands clasped.

Goethe was a remarkably handsome man. A bust of him in the ducal library at Weimar represents him as Apollo. Goethe also impressed those who met him by the splendor of his mind and his distinction of manner. Napoleon, after meeting him, exclaimed, "Voilà un homme!" ("There is a man!") There have been greater men and greater writers, but few have been so great both as men and as writers.

Goethe's chief works, in addition to his prose writings and songs, odes, etc., were: 'Goetz von Berlichingen' (1773); 'Werthers Leiden' (Sorrows of Werther), 1774; 'Iphigenie auf Tauris' (1787); 'Egmont' (1788); 'Torquato Tasso' (1790); 'Reineke Fuchs' (Reynard the Fox), 1793; 'Wilhelm Meisters Lehrjahre' (Wilhelm Meister's Apprenticeship), 1796; 'Hermann und Dorothea' (1797); 'Aus meinen Leben: Dichtung und Wahrheit' (1811, 1812, 1814, 1833, autobiography); 'Faust', complete (1831).

The METAL *that Measures the* WORLD'S WEALTH

FOR gold men have toiled and died; wars have been waged for it, and it has inspired crimes of the deepest dye. "To what dost thou not compel the minds of mortals, accursed greed for gold?" indignantly asked the Roman poet Vergil. On the other hand, the search for gold has been one of the most important motives in the spread of civilization. The "pot of gold at the end of the rainbow" has been the reward for which men have braved the terrors of unknown lands, and the prospector has blazed the trail for the settler to follow. The Spaniards who conquered Mexico and South America were seeking gold; it was the gold rush of '49 that started the settlement and development of the Pacific coast; and the first important start of Australia toward greatness followed the discovery of gold in 1851. Similarly the discoveries of gold in Alaska and South Africa were great factors in the development of those countries.

GOLD. Although gold is widely distributed over the earth, it occurs mostly in such small quantities that it cannot be profitably extracted. It is even found in minute quantities in sea water. Despite the fact that gold has been mined from remote antiquity, the amounts recovered have been so small and have required such expenditure of time and labor that it remained the most precious of metals until the discovery of a few even rarer metals in recent times. The total world production of gold, from the discovery of America to 1916, is estimated at about 16½ billions of dollars, weighing about 20,500 tons—enough to make a circular tower of gold 20 feet in diameter and 138 feet high.

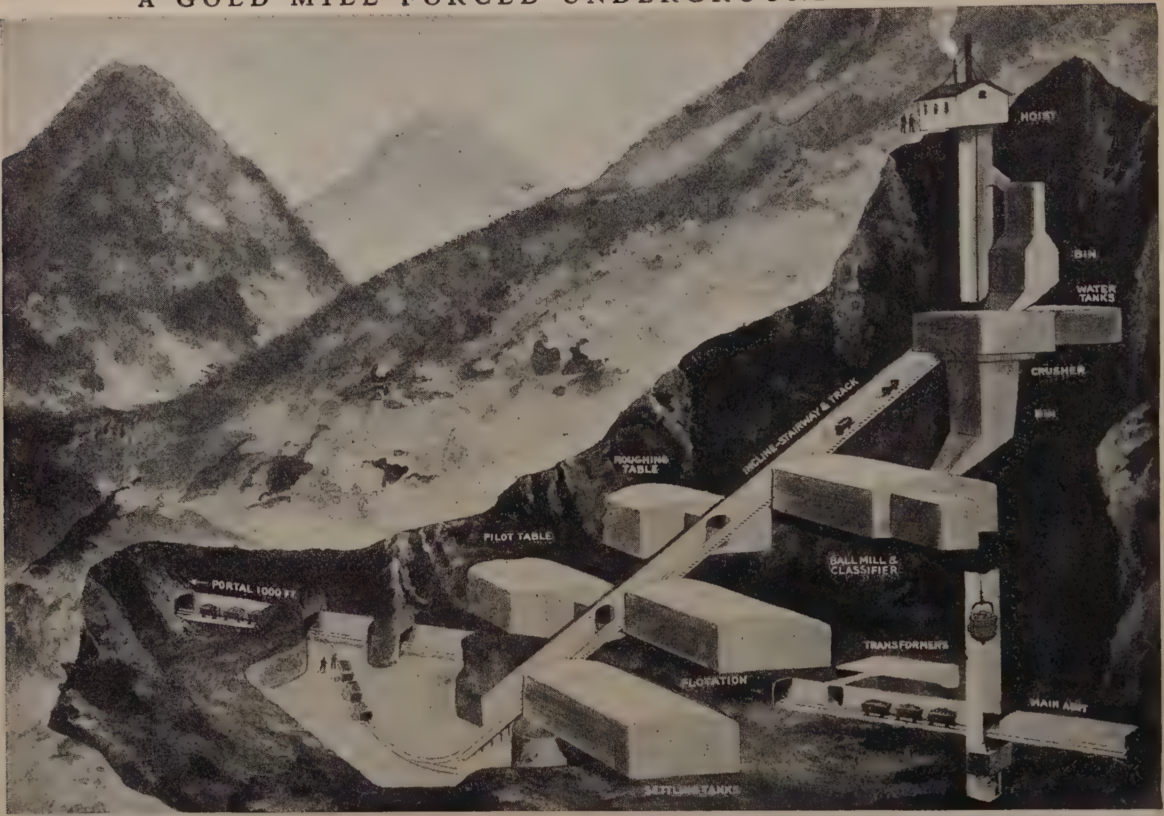
Most of the gold mined in the earlier days was produced in the Spanish Peninsula, Greece, Asia Minor, India, and the Ural Mountains of Russia. After the discovery of the New World, great supplies were obtained from Central and South America, but the total production from that time to the discovery of the California gold fields was less than the average annual production today. An enormous jump in production resulted from the discovery of the California deposits (1848) and other great fields, the most important of which are, with dates of discovery: Australia (1851); British Columbia (1858); New Zealand (1858); British India (1884); Witwatersrand, South Africa (1886); Alaska (1897).

The greatest gold-producing region today is the Witwatersrand district of South Africa. Johannesburg is the largest gold-mining center with an output which some years has exceeded $150,000,000. The United States, including Alaska, ranks next to South Africa in production, with California first, Colorado second, and Alaska third. Until the World War Russia produced twice as much gold as all South America. The Mysore mines in India have been big producers and have shafts more than 4,000 feet deep. The deepest gold mine in the world is the Morro Velho, Brazil, 6,126 feet deep.

Gold is found both native—that is, uncombined with other minerals—and in combination with various other elements. Native gold occurs in rocks, in many cases in quartz veins, and some iron pyrites. It also is found in some sands and in beds of gravel deposited by rivers.

There are two principal methods of mining gold: (1) "placer" mining for alluvial deposits, and (2) "lode" or "quartz" mining, where the gold is in solid rock. Placer mining was known in ancient times. Gold washing as early as 4,000 B.C. is shown in pictorial rock carvings in Egypt. The legend of the Golden Fleece may have been suggested by the use of fleeces to catch gold in ditches and flumes. In placer mining nature has already done the greater part of the work. In the process of wearing down the "eternal hills" by erosion, gold, being one of the heaviest of minerals (19.27 times as heavy as water), naturally goes to the bottom of streams. There it is deposited in the form of scales or nuggets, for the most part in the same shape in which it was originally held in the rock. The size of the particles varies from fine powder (gold dust) to the great Australian "Welcome stranger" nugget, weighing 2,520 ounces —the weight of a medium-sized man. The separation of gold from the gravel and sand is accomplished on the same principle that has been in operation

A GOLD MILL FORCED UNDERGROUND BY SNOW



A mining company in the mountains of Ouray County, Colorado, devised this scheme to escape the snow slides which were constantly destroying their property. The plan shows all the parts of the mill tunnelled out and excavated beneath the surface of the hill. All that is visible above ground is the small hoist-shed.

through the agencies of nature. Masses of the gold-bearing gravel are stirred up with water and the heavy gold sinks to the bottom. This is done on a small scale in a prospector's pan, and on a large scale in sluices. In hydraulic mining, great beds of gravel are washed out by streams of water conducted through pipes like a fire hose. These jets are so powerful that men and animals have been killed by them at a distance of 200 feet from the nozzle. Gold dredging is also carried on by means of flat-bottomed boats with devices to dig gravel from the bed of the stream or from the bottom of the sea when the water is shallow. Of course not all gravels and sands contain gold.

Mercury, which readily unites with gold, is put into the gold-bearing gravel, thus catching fine particles of gold which might otherwise escape. The resulting amalgam is separated by retorting—that is the mercury is vaporized by heat and the gold is left free, to be melted into bullion.

Placer mining is becoming less important because easily obtainable gold is becoming scarcer, and most of the world's gold today is obtained by lode mining. The gold-bearing ores are taken out of the rocks, crushed in stamping-mills, and passed over copper plates covered with mercury to catch as much of the free gold as possible. The ores still contain a large proportion of gold, however, so further treatment is necessary. This usually takes the form of the cyanide process, in which a solution of cyanide of potassium is poured over the concentrated ore, dissolving the gold. From this solution the gold is precipitated on zinc shavings, or by electrolysis (*see* Electrolysis). Another process, less used, consists in roasting the ore to convert all the metals except the gold into oxides, then treating the roasted ore with chlorine gas (*see* Chlorine), which unites with the gold to form gold chloride. The gold chloride is dissolved in water, and the gold is precipitated by various reagents. This chlorination process is less thorough than the cyanide process. In the great Rand mines little more than 55 to 65 per cent of the gold was extracted from the ore before the introduction of the cyanide treatment in 1890. Since then, about 94 per cent of the gold has been saved.

As first extracted from its ores gold nearly always contains some silver, copper, or other metal, which must be separated. This separation, or refining, is done at refineries or at the mint, by electrolysis or by treatment with chemicals. Since pure gold is too soft for ordinary use, it is nearly always alloyed with copper or silver, or both. The gold coins of the

United States are alloyed with copper. These metals change the color, copper making the alloy redder than pure gold, and silver whiter. The proportion of gold contained in an alloy is expressed in two ways: in *carats*, that is, the proportion on a scale of 24; or in *fineness*, on a scale of 1,000. Pure gold is 1,000 parts, or 24 carats fine. Gold with 18 parts pure gold and 6 parts of alloy is 18-carat gold, or 750 parts fine. The legal standard for gold coinage in Great Britain is 22 carats, or 916.6 parts; in the United States, Italy, and Germany, it is 21.6 carats or 900 parts. The value of pure or 24-carat gold is fixed by United States law at $20.67 an ounce and the commercial standard varies little from this in ordinary times.

In malleability gold stands first among the metals, being capable of being beaten to a thickness of 1/250,000 of an inch. It is placed between the thin outside membrane of the intestine of cattle, and several layers are pounded at the same time. The resulting gold leaf is used for lettering signs on the glass of doors and windows,

HOW THE PRECIOUS METAL IS DUG OUT

These machines represent two of the principal methods used in obtaining gold — dredging and mining. In the upper picture is the chain of buckets with which the big dredge scoops gold-bearing gravel from the bed of the California river where it operates. Within the dredge is machinery which extracts the gold. Below is the entrance to a gold mine in the Transvaal, South Africa, showing cars loaded with ore.

HOW GOLD IS PREPARED FOR USE IN INDUSTRY

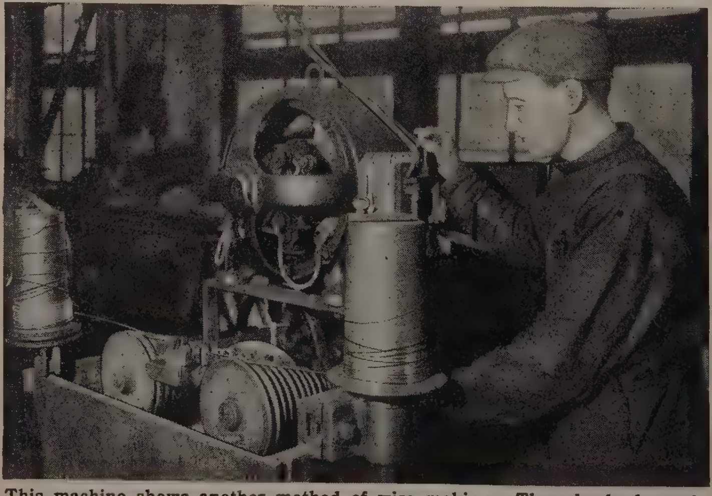
These two pictures show how gold is reduced to thin strips for the use of jewelers and others. A bar of gold is passed through the rollers and flattened. A turn of the hand wheel on top reduces the space between the rollers and the bar is passed through again. The process continues until the desired thinness is obtained.

for interior and sometimes exterior decorations, for picture frames, and for experimental work in electricity.

Gold is also the most ductile of metals. Wires compounded of silver and gold have been drawn to such fineness that 20,000 of them would be less than an inch thick, and a length of 500 feet weighs only one grain. Gold lace is made of thin gold wires so fine that from 1,100 to 2,000 yards weigh but an ounce. These wires are flattened into ribbons and wound over silk thread. Cheaper varieties are made of thin copper wire plated with gold.

Rolled gold, which is often used for watch-cases and jewelry, is produced by applying thin sheets of gold to a plate of alloy and rolling them together until the gold and the alloy are firmly welded.

Here we see the making of gold wire. As the wire passes into the machine, many little hammers beat upon it and reduce its diameter.



This machine shows another method of wire making. The wheels draw the wire through a succession of dies, each of which makes it thinner.

Gold resists chemical action to a greater degree than any other common metal. One of the few acids which will dissolve it is a mixture of nitric and hydrochloric acids, which early experimenters called *aqua regia* ("royal water") because of this power. The resulting chloride of gold, in combination with certain other chlorides, forms salts which are called gold chloride and are used in photography. In combination with tin chloride, gold chloride produces a fine purple pigment, called purple of Cassius, which gives a rich pink, rose, or red color to glass, pottery, and enamel. About three-fourths of the world's production of gold is used for commercial purposes. The rest is made into coins, for gold is now the legal monetary standard of most great nations.

Goldenrod. Tossing and waving in the autumn winds along dusty roadsides and in swampy fields, this spendthrift weed heralds the end of the year's floral pageant like a glorious sunset bringing to the close a beautiful day. Because of its wide distribution in the United States, the goldenrod is favored by many for adoption as the national flower. It offers a veritable Chinese puzzle botanically, for an accurate description and identification of the 85 or more known species would be a hard task for the most learned botanist.

The goldenrod belongs to the family of composite flowers and is akin to the thistle. Only two or three species are found in Europe. One species, the so-called "white goldenrod" or "silver-rod," lacks the characteristic golden hue. Another species, common in the pine barrens of New Jersey, gives off an anise-like fragrance when crushed, and its dried leaves and flowers were formerly used to make a medicinal tea. The goldenrods have a prolonged season of blooming, and the bright flowers and the ease with which the nectar is to be obtained attract many insects. When the flower clusters fade, the seeds tipped with fine feathery hairs are wafted in every direction, later to be sought by the goldfinch and the song sparrow when the winter's store of food runs low.

Scientific name of goldenrod genus, *Solidago*. The blue-stemmed or woodland goldenrod (*Solidago caesia*) has an unbranched stem of bluish hue and lance-shaped leaves; the flowers grow along the stalks in the axils of the leaves. *Solidago uliginosa* is the bog goldenrod, with stem 2 to 4 feet high, and with flowers forming a compact terminal spike. The showy goldenrod (*Solidago speciosa*) attains 7 feet in height with widely branching stem often stained with red. The early or plume goldenrod (*Solidago juncea*) is branching but shorter; its plumes are often dried for winter decoration. The Canada goldenrod (*Solidago canadensis*) is probably the largest, showiest, and most common of the family, flourishing from Newfoundland to Florida, and westward to British Columbia and Arizona.

Goldfish. Swimming proudly in its suit of burnished gold or bright red jacket with black or silver trimmings, the goldfish knows nothing of its humble ancestor, the dull-colored carp. Yet the wonderful variations of color and form which we find so attractive were produced by the skill and infinite patience of Chinese and Japanese breeders. For centuries individual variations were carefully bred and selected until the golden color was firmly fixed, and innumerable forms, from the beautiful to the grotesque, were produced. But blood will tell; and as soon as the care of the breeder ceases, the goldfish tend to lose their brilliant coloring. Specimens that escaped from the fountains in Washington to the Potomac River have produced young that returned to the original greenish hue.

Some of the most valuable goldfish are not golden at all. For example, the "fantail" is occasionally a brilliant and showy black, and others are virtually white. One of the prettiest varieties is the "fringe-tail," whose enormous shimmering tail produces effects that a dancer might envy as the little fish moves in the sunlight. Probably the ugliest kind is the one most prized in the Orient. This is the "telescope fish," so called because of its large and bulging eyes, which the Japanese are continually trying to make larger and more bulging. In Japan goldfish are so popular as pets that more than 20,000,000 are sold each year.

Scientific name, *Carassius auratus*. It is a native of China, whence it was introduced into Japan and Europe. Goldfish should be fed only once a day, in the morning at a regular time, and only as much as they can eat at once. The best aquarium is one in which water plants are growing. The ordinary fish globe should not be used, since the curving sides allow but a small part of the surface of the water to reach the air (*see* Aquarium).

Goldsmith, Oliver (1728–1774). There are few more eccentric or more lovable characters among literary men than the reckless, irresponsible, happy-go-lucky, generous Goldsmith. He was born in a little village in Ireland, where his father was a simple kindly clergyman, much like Dr. Primrose in the 'Vicar of Wakefield'. Young Oliver was regarded as "a stupid blockhead" at school, and seemed a most unpromising lad in every way. At Trinity College, Dublin, his escapades brought him into disfavor with the authorities, and here he fell into the habit of squandering what little money he had and getting into debt, but he managed somehow to obtain his degree in 1749.

At the urging of his family Goldsmith now spent two years studying theology, but when he presented himself as a candidate for holy orders in the Church of England, he was rejected. He made an attempt at law, but failed in this also. Then he went to Edinburgh to study medicine. After remaining there a year and a half, he set out on a year's tramp through Europe. Earning his way by playing the flute he wandered through Flanders, France, Switzerland, and Italy. He came back with a medical degree, though how he obtained it no one ever knew; and it was of little service to him, for he met with no success in practice as a physician.

Failing in various other occupations, Goldsmith turned to literature as a last resort. In his little garret at the top of "Breakneck Stairs" in London, he wrote essays, reviews, histories, etc., most of which have been forgotten. But among these were a series of observations on English civilization, afterwards published (1762) as 'The Citizen of the World'. These essays attracted the attention of Dr. Samuel Johnson, the great literary leader of the day. He befriended Goldsmith and made him a member of his famous club, to which the actor Garrick, the artist Reynolds, the historian Gibbon, the brilliant orator and statesman Edmund Burke, and other famous men belonged (*see* Johnson, Samuel). In this brilliant circle Goldsmith was laughed at for his oddities and blundering ways, but loved for his goodness of heart and unfailing good humor.

His writings brought him some means, but as a result of his love of gay clothes, and fine dinners, his habit of gambling, and the ill-advised generosity which led him to help any begger who sought his aid, he was always in debt. In his 47th year he fell ill of a fatal fever, which was aggravated by his own attempts to cure himself and his constant worry over his many financial troubles.

"Let not his frailties be remembered," said Dr. Johnson after Goldsmith's death; "he was a very great man." This verdict has been accepted by the literary world. Of all his works 'The Vicar of Wakefield' (1766) is the favorite. Dr. Primrose, the simple, true-hearted clergyman, whose happy faith triumphs over all misfortunes, and the blundering Moses, so like Goldsmith himself, are among the characters that are never forgotten, while the simple, wholesome village life pictured in this novel never loses its power to charm. Much of the same charm is shown in 'The Deserted Village' (1770), one of the few poems in an artificial age to appeal to human sympathy and love of nature. His comedy 'She Stoops to Conquer' (1773) has been played again and again, and its hearty fun never grows stale.

THE CAREFREE OLIVER AND HIS FLUTE

What a lovable, carefree genius Oliver Goldsmith was! Here we see him going across the fields with the beloved flute with which he earned his way in his year's tramp through Europe. Goldsmith needed a little mixture of the practical in his make-up, as this practical and somewhat prosaic age of ours needs a touch of Goldsmith's appreciation of certain great things of life that money cannot buy—the simple joy of living, and the play of imagination.

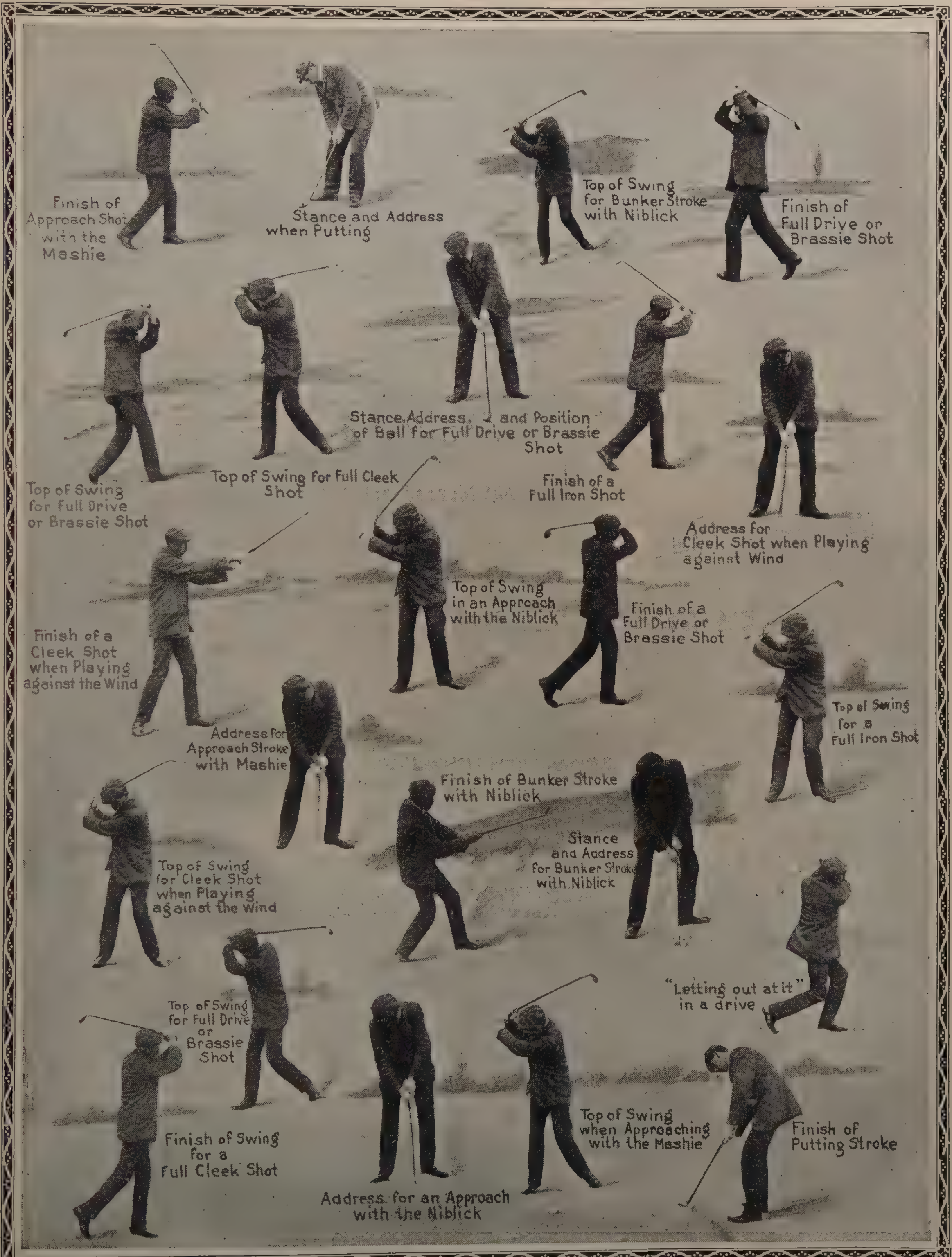
GOLF. Golf is one of the few games for both old and young, for champions in this difficult and fascinating sport have been as young as 18 and as old as 60. More than any other game perhaps, golf calls for a spirit of courtesy and fairness. A player stands quietly aside while his opponent makes his strokes. He assists in every way to give this opponent an equal chance with himself, and should a player lose a ball the other searches for it as diligently as if it were his own. Golf also puts a player on his honor, for he alone keeps track of his own score. These facts, combined with the skill required to excel and the excellent physical exercise obtained, usually in the midst of attractive scenery, fully entitle golf to be known as "the royal game."

The ideal golf course consists of 18 "holes" at various distances apart, from about 100 yards to more than 500 yards. At the beginning of each hole there is a "tee." This is a level plot of ground about 12 feet square, from which the players "drive off" into the "fairway," which is the name given to the broad avenue of turf leading to the hole itself. For 200 yards, perhaps, this fairway is smooth and undulating, with no obstructions, though woods and tall grass may flank it on both sides. Then a "hazard"—an obstruction either natural or artificial, such as a brook or a ditch or a mound of earth fronted by a sandpit—may cut across the fairway and form a trap for the unwary player. If the golfer hits his ball into one of these traps he may have considerable difficulty in knocking it out, but if he plays skilfully he remains outside the traps and is able to approach "the green," which lies at the end of the hole, without wasting any strokes.

The Green, the Flag, and the Hole

The "green" is a plot of ground of no regulation size or shape, but usually about 30 or 40 feet in diameter. Here the grass is cut close, and in the center is a hole about 4 inches in diameter, lined with metal and designated by a flag or marker on an iron rod or bamboo pole. When the golfer is at a distance from the green, the flag indicates the correct direction for his stroke. As soon as the player succeeds in "sinking" his ball in the hole and his opponent has done the same, they both move on to the next tee and continue to play in the same manner until they have

SOME OF THE STROKES IN "THE ROYAL GAME"


Finish of Approach Shot with the Mashie
Stance and Address when Putting
Top of Swing for Bunker Stroke with Niblick
Finish of Full Drive or Brassie Shot
Stance, Address, and Position of Ball for Full Drive or Brassie Shot
Top of Swing for Full Drive or Brassie Shot
Top of Swing for Full Cleek Shot
Finish of a Full Iron Shot
Address for Cleek Shot when Playing against Wind
Finish of a Cleek Shot when Playing against the Wind
Top of Swing in an Approach with the Niblick
Finish of a Full Drive or Brassie Shot
Top of Swing for a Full Iron Shot
Address for Approach Stroke with Mashie
Finish of Bunker Stroke with Niblick
Stance and Address for Bunker Stroke with Niblick
Top of Swing for Cleek Shot when Playing against the Wind
"Letting out at it" in a drive
Top of Swing for Full Drive or Brassie Shot
Finish of Swing for a Full Cleek Shot
Address for an Approach with the Niblick
Top of Swing when Approaching with the Mashie
Finish of Putting Stroke

These pictures show the correct "stance" (position of the body) and the right way to execute some of the varied strokes that make golf so fascinating a game. Every detail of these shots must be practiced with the utmost care, and any player who hopes to excel must be careful to get them right when starting to learn the game. Bad golfing habits are quickly formed at the outset, and once a player acquires them, he overcomes them only with the greatest difficulty.

made the round of the 18 holes. Some golf courses consist of only nine holes, and in that case the usual practice is to make two rounds.

The object of the game is to send the ball into each of the holes successively in the fewest possible number of strokes. In "match" play each hole is counted separately. The winner is the one who has the most holes to his credit when the course has been completed. In "medal" play, the golfer who makes 18 or 36 holes—according to agreement—in the lowest total number of strokes is the winner, whether or not he wins the most holes.

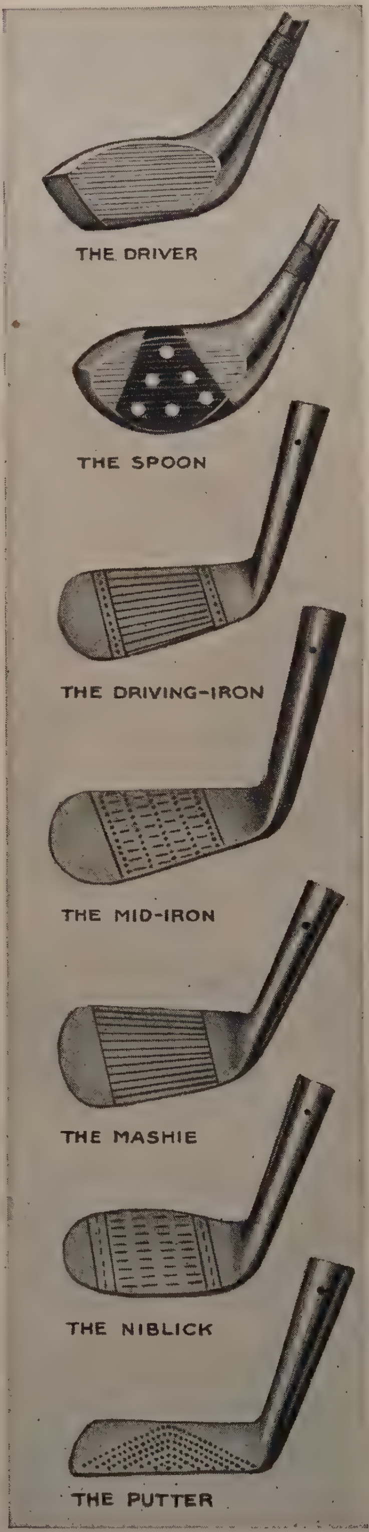
The golfer may play alone or he may play with two or three others. When four play it is common practice to choose partners and to compete in match play. Whenever a player and his opponent complete a hole in the same number of strokes the hole is "halved" and counts for neither.

The ball, about 1¾ inches in diameter, is made of many strands of rubber wound around a core which is usually of solid rubber or steel. The core is sometimes a liquid or paste in a rubber container, with the idea of giving greater resiliency to the ball. The gutta-percha casing is variously marked to lessen wind resistance and give greater carrying power.

Most players use six or eight clubs of different kinds, each adapted for its own particular kind of stroke. The clubs have a slender handle about three feet in length, often made of hickory, and a strong wooden or iron head with which to hit the ball. When driving off at the tees the player may place the ball upon a little elevation of sand that gives him a chance to get the most effective stroke. In driving a ball from a tee the golfer usually uses a wooden-headed club called a driver. Two hundred yards is a good drive, but many players are capable of driving more than 250 yards.

The other clubs—the "brassie," the "cleek," the "midiron," the "mashie," the "niblick"—are variously designed for driving the ball low and far, or raising it high in the air and letting it fall "dead," or clearing obstacles, or "lifting" it out of holes or tall grass. On the green the player uses a short straight-faced club called a "putter." The players' clubs are usually kept in a bag which is carried by a small boy called a "caddie." Many of these boys have developed later in life into champions at the game.

THE CHIEF GOLF CLUBS



These are the seven clubs most useful to the golf player.

The history of golf runs far back into the early centuries. The Romans, soon after the beginning of the Christian era, played a game with a mallet and a leather-covered ball stuffed with feathers, called *paganica;* the French in early times had a game akin to golf called *jeu de mail;* and the Dutch played a stick-and-ball game on the ice called *het kolven.* In each of these games the object of the player was to send the ball so it would strike a mark such as an upright stick. While the Dutch and the French were still hitting at marks, the Scotch refined the game by making holes in the ground to receive the ball. In 1457 the Scotch were playing the game so enthusiastically that Parliament, either fearing that the game might have a questionable moral effect on the people or that it might supersede archery, forbade the game, and in fact did not cease to interfere with the sport until 1491.

In the United States a crude form of golf was played as early as 1659. The authorities of Fort Orange—now Albany, N. Y.—passed an ordinance in that year forbidding the people to play golf along the streets on account of damage to windows and danger to pedestrians. Not until 1890, however, did modern golf secure its first real foothold in the United States and Canada. Today, it is said, there are nearly a million golf players in North America. The game has had much to do with the increasing number and popularity of country clubs, one or more of which are found near every city of any size in America. Probably the most famous golf course in the world is that of the Royal and Ancient Golf Club of St. Andrews in Scotland.

The rules for the game have an interesting history. So long as the game was practically confined to a few clubs in Scotland, tradition and custom, passed from generation to generation, made rules largely unnecessary. But the spread of the game, with elaborate championship contests, created the need for a detailed code. In response to a widespread public demand, the St. Andrews club established a large standing committee and published decisions which long were the rules of the game. Later, interclub associations became important legislative bodies.

In the United States the rule-making function has been discharged by the United States Golf Association and the Western Golf Association. American rules, however, conform closely to those of Great Britain, and international competitions and committee conferences tend to keep the two uniform.

GOMPERS, SAMUEL (born 1850). As president for nearly 40 years of the American Federation of Labor, Samuel Gompers is one of the outstanding figures in the American union labor movement. Born in London, at the age of ten he went to work for a shoemaker, but soon became apprenticed to a cigar-maker, and learned that trade. He came to New York with his parents in 1863, and was active in the Cigar-Makers' International Union for many years. Then in 1881 he helped to organize the American Federation of Labor (*see* Labor Organizations), and the next year became its president, a position which he has held ever since except for one year.

During this long period he has maintained a firm leadership of the labor movement, guiding it into moderate channels. Today he is the head of a powerful body of nearly 4,000,000 men and women, of every race, language, trade, and condition. He has constantly opposed the formation of a separate labor party, advocating the use of the indirect influence of the organization in voting for candidates who are friends of labor. Some of the success of this policy may be seen in the laws passed for the benefit of the working man—employers' liability laws, the eight-hour day on government contracts, etc. No capitalist has fought more determinedly against socialism and "bolshevism" than has Samuel Gompers, who declared these movements economically unsound, socially wrong, and industrially impossible. Industrial conciliation, he believes, is the remedy by which the laborer should seek to gain his ends. The vigorous stand he took in support of the participation of the United States in the World War fittingly crowned a remarkable career.

GOOSE. The goose is a bird of wide popularity. Through "Mother Goose" it belongs to the nursery; the fable of the "goose that laid the golden egg" takes it into the schoolroom, where later it figures as the heroic bird that saved the city of Rome, and as furnishing Tiny Tim's Christmas dinner in Dickens' famous 'Christmas Carol'. Sportsmen prize the wild goose, and the domestic goose is of great importance to housewives not only for its flesh and eggs but for its feathers which supply their pillows and feather beds. Goose fat is largely used in place of lard for cooking, and from the livers is made the pâté de foie gras for which Strasbourg is famous.

There are about 30 species of wild geese, belonging to the same family as the ducks and swans. The

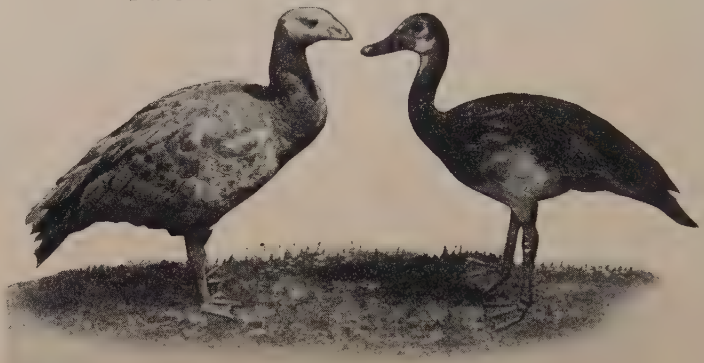
WILD GEESE AT HOME FOR THE SUMMER IN CANADA

The picture shows Mr. and Mrs. Wild Goose escorting their children over a marsh in Saskatchewan, and seeing to it that the youngsters eat and grow strong in preparation for the autumn, when they must make the long flight to the Gulf of Mexico. The picture is from a group in the American Museum of Natural History.

male, called the "gander," resembles the female in plumage. All breed in cool and temperate regions, some in the Arctic Circle. All migrate south for the winter. Geese live to be at least 30 or 40 years old.

Of the European wild geese the "graylag" is the most representative. It ranges over nearly the whole of Europe and northern Asia, and is the original of most domestic geese. China is the home of the "swan-goose," the largest known variety, and the parent stock of the domestic geese of the Orient. The "Cape Barron goose," which is remarkable for the shortness of its beak, is found in Australia.

TWO GEESE OF DISTANT LANDS



To meet the sharp-nosed goose on the left, you would have to go to Australia, for he is a Cape Barron goose with an extremely short beak like a turkey's. He can get around on land much more rapidly than the ordinary goose, but he lacks the family fondness for swimming and flying. Facing him is the African spur-winged goose, who gets his name from a long spur on each wing. He has more of the family nose, as you see.

The "Canada goose" is the most familiar of American wild geese. It is a grain-feeding bird and its flesh is most palatable. Breeding in Canada or the northern United States, it stops in its southward migration to visit the grain and stubble fields of the great northwest, often remaining in the Dakotas until mercury has reached 20° below zero. This is the harvest time for sportsmen, and often family larders are provided with meat from this source for the entire season. The birds are about 40 inches in length, light gray plumage below and darker grayish brown above, with a black head. In their spring flight north they are welcomed as an unfailing sign of coming summer. They fly high, in a V-shaped wedge, their joyous honking claiming attention of young and old:

> Hark what a clamor goes winging through the sky!
> Look, children! Listen to the sound so wild and high!
> Like a peal of broken bells,—kling, klang, kling—
> Far and high the wild geese cry, "Spring! It is spring!"
> —*Celia Thaxter.*

The "snow goose" is a pure white arctic bird that migrates to the Gulf States in America and to Japan on the Asiatic coast. They are still numerous along the Pacific coast during the winter. The "brant" is a small goose common throughout the Northern Hemisphere. In early autumn these birds come by the thousands to the coasts of the United States, and are a plentiful and valuable source of food supply for our tables.

Domestic geese date from a very remote period, as they are shown on the monuments of ancient Egypt. Wing-feathers of the goose feathered man's arrows in the Middle Ages, and supplied him with quill pens until steel pens took their place.

Geese belong to the order *Anseres*. Scientific name of graylag goose, *Anser anser;* of Canada goose, *Branta canadensis;* of the brant, *Branta bernicla glaucogastra.*

GOOSEBERRY. The tart flavor of the gooseberry is enjoyed in sauce, jam, and marmalade, but does not greatly tempt one to pick and eat the raw fruit. Even as the fruit ripens, changing from green to a rich dark purple, the acid flavor lingers, especially around the coarse seeds. So the gooseberry is not very popular among garden fruits, and much of our supply comes from the bushes growing wild all through the northern part of the United States. Varieties of the gooseberry are also native to the north temperate regions of the Old World, but everywhere the cultivation of the fruit has been neglected with the exception of England. There cultivation began in the 16th century, with the result that English markets have gooseberries as large as plums and sweet enough to eat just as they are picked from the bush.

The gooseberry is a hardy spiny shrub closely related to the currant. Scientific name, *Ribes grossularia.*

GOPHER. In the early days French settlers gave the name "gopher" to several species of burrowing animals of the rodent family. The name comes from the French *gaufre* ("honeycomb"), and was given because the little animals honeycomb the ground by burrowing in it. They do much damage to the crops and are considered a great pest by the farmers.

The prairie pocket gopher commits its depredations in the fertile prairie region of the farther northwest. It is about as long as a small rat, with a body considerably thicker; in the skin of each cheek is a large pocket or pouch in which to carry stores of food. The fore feet are very strong and are equipped with long claws for digging.

With his hind feet the gopher scrapes from beneath his body the dirt the front feet have dug and throws it back a distance of 8 or 10 inches. When a little pile has been made in this way, the gopher turns around and putting his forepaws in front of his nose pushes the dirt before him through one of his "cellar doors" and so makes the little piles called gopher hills.

The gopher's teeth make something like 200 strokes a minute. The enamel plates of the molar teeth are arranged in such a way that 38 distinct single cuts are made with every forward thrust of the jaw and

28 by the back stroke. Multiply that by 200 and it amounts to over 13,000 cuts every minute.

To keep food for winter use, gophers have regular storehouses — pantries, as it were — to which they carry roots and other food in their cheek pockets. In one gopher storehouse in the winter time were found nearly 50 tiger lily bulbs, gathered the previous fall and carried through a tunnel from the tiger lily bed to the gopher pantry. Gopher burrows are extended year after year, and in many cases the tunnels dug by a single gopher in 12 months would measure a mile or more if straightened out and placed end to end. The tunnels are full of crooks and turns, caused by going around stones or following "leads" of soft earth.

MR. GOPHER AS A BUSINESS MAN

A Gopher is a clumsy looking fellow, but how he can cut and stow away the roots! With those long upper front teeth he anchors himself to his job; then the lower incisor shoots back and forth like a steam drill until he has cut off a piece of root and passed it into his mouth. The digging and shoveling are done with that short stout nose and those long powerful curved claws that seem almost too big for him.

The so-called "striped gopher" of the Central States is really a ground squirrel but it is no less troublesome. Natural enemies of these pests are the weasel and the gopher-snake. Farmers also try to keep their numbers down by traps and poison.

Pocket gophers are a large family, the United States having three genera with 78 species and subspecies, which vary widely in size and color. Scientific name of the prairie pocket gopher, *Geomys bursarius.*

GORDON, GEN. CHARLES GEORGE (1833–1885). "Chinese Gordon," as he was commonly called, was a British officer whose love of danger, combined with a religious enthusiasm which verged on Oriental fatalism, crowded his career with romantic adventures. One of the secrets of the extraordinary deeds he accomplished was his genius for leadership, especially among non-European peoples.

He was the son of a British general, was educated at the Royal Military Academy at Woolwich, and began his career in the British army in 1852 with a lieutenant's commission. He served with conspicuous gallantry in the Crimean War, and afterwards in Asia. At the age of 30 we find him commander of the "Ever Victorious Army" of China, putting down the Taiping rebels who sought to drive out the unprogressive Manchus and to establish "the reign of eternal peace." In 1864, within 18 months after Gordon had taken command, the ten-year-old rebellion which had cost millions of lives was relentlessly suppressed. The grateful Chinese thereupon conferred on Gordon the yellow jacket and the peacock feather of a mandarin.

The next nine years of his life were spent in the more prosaic but perhaps more useful work of constructing forts in England and serving on various international commissions. Then in 1873 he accepted service under the Khedive of Egypt as governor of the Egyptian equatorial province. For seven years he labored to establish law and order, but his work was not very successful.

In 1884, four years after he resigned this commission, he was sent back to the Sudan by the British government. His commission was to bring out of the region the Egyptian garrisons endangered by the revolt of the "Mahdi" or Prophet, a religious leader whose aim was not unlike that of the Taiping rebels in China. But in disregard of his orders General Gordon sought to hold the district and was besieged in the city of Khartum. For ten months the city held out; when it finally fell (Jan. 26, 1885), two days before a British relief expedition reached it, the whole garrison, including its brave but erratic commander, was massacred.

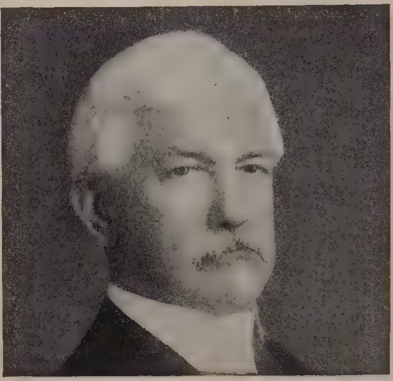
The death of Gordon raised a storm of indignation in England against the slowness of the government in sending aid. Gladstone, then prime minister, pointed out that Gordon had disobeyed his orders in not leaving the Sudan when he could, but public opinion could not forget his chivalrous heroism and regarded him as a martyr. So he was—to his own headstrongness and the spirit of imperialism, which, however, did not rule the councils of the Liberal government then at the helm in England. Tennyson wrote the epitaph for his tomb in Westminister Abbey.

CHARLES GEORGE GORDON
One of England's Warrior Heroes

ONE OF AMERICA'S GREATEST CONQUERORS

The Man who Vanquished the Deadly Mosquito

GORGAS, Gen. William Crawford (1854–1920). It is a great thing to uphold the honor of one's country on the battlefield, especially when the conflict is in defense of liberty, of justice, of the rights of men peaceably to rule their affairs. But there are conquests even greater than those over hostile armies—such are the conquests over the forces of disease and death and the suffering of little children. And so we may truly say that one of the greatest conquerors that America ever produced, a man worthy to rank with Washington or Grant or Pershing, was an army officer who only late in life rose above the rank of colonel; who conquered malaria and the deadly yellow fever in Cuba and the Panama Canal Zone and thus made possible the construction of the Panama Canal; and who at his death, at the age of 66, was recognized as the world's foremost sanitarian.



WILLIAM CRAWFORD GORGAS

The family of William Crawford Gorgas was well known in Alabama, where the boy was born shortly before the Civil War. His father was a general in the Confederate army and the collapse of the Southern cause brought the family a full share of hardships. "I first came to Baltimore," said the son, at one time, "about 45 years ago—a ragged, barefoot little rebel, with empty pockets and still more empty stomach. My father had gone south with Lee's army. At the fall and destruction of Richmond, my mother's house, with all that she had, was burned, leaving her stranded with six small children. She came to Baltimore, and was there cared for by friends. These memories are vivid with me, and can never be effaced."

Young Gorgas received his education at the University of the South at Sewanee, Tenn., of which his father had become president. After graduating from Bellevue Medical College, New York, he entered the United States Army as a surgeon, and while stationed at Fort Brown, Tex., had his interest first aroused in the terrible scourge—yellow fever—which he was later to do so much to combat and conquer.

Dr. Gorgas in the Spanish-American War

During the Spanish-American War Dr. Gorgas served as chief sanitary officer of Havana, Cuba, which for years had been notorious as a center of yellow fever. There he won his first world fame by ridding the city almost entirely of this plague. He was practically the first to apply the new discoveries—that both malaria and yellow fever can only be spread by the bites of certain species of mosquitoes, which in turn have become infected by biting persons infected with these diseases (*see* Mosquito).

In reward for his work at Havana Dr. Gorgas was created colonel by special act of Congress, and shortly afterward was appointed as chief sanitary officer of the proposed Panama Canal.

The story of the great work which he did there is told more fully elsewhere (*see* Panama Canal). Colonel Gorgas and his men worked especially in four great ways: They destroyed the homes of mosquitoes during the larval stage within a hundred yards of all human dwellings; they destroyed all protection for adult mosquitoes; they screened all houses with wire screens; and they destroyed all breeding-places, either by draining stagnant waters dry or sealing them with crude petroleum, which spreads a film over the surface and kills the larvae.

The War against the Death-bearing Mosquito

Never was there known so great a "pouring of oil upon troubled waters"; never was there known so silent a battle between an army of hundreds on one side and hundreds of millions on the other. On one side were a few hundred men—doctors and ditchers, drainers and dispensers, oilers and clerks and sanitary inspectors—guarding 40,000 or 50,000 laborers and their families, scattered over 450 square miles in about 40 camps and villages. They were doing the biggest piece of engineering that has ever been done on the earth, digging a way from sea to sea, cutting up a mountain for the sea to pass through, and building huge walls to hold in the sea as it passed. On the other side were millions of mosquitoes of the race *Stegomyia* and *Anopheles*, born in stagnant waters, but emerging with their powers of death to fly through every door and window to suck the blood of any human being and poison the life-blood of all Panama, as their ancestors had poisoned it for ages, with yellow fever and malaria.

Without the remarkable work of Colonel Gorgas in stamping out these diseases, the canal might never have been completed, certainly not without appalling loss of life. It has been estimated that in the ten years that the canal was building he saved more than 70,000 lives, and $80,000,000. His achievement marked an epoch in the history of sanitation, and in the work of making the tropics habitable for the white man. It was not too much now to expect, as Colonel Gorgas prophesied, that "some day a case of yellow fever will be regarded as a medical curiosity."

At the completion of the canal, in 1914, Colonel Gorgas was promoted by his government to be Surgeon-General of the United States Army, and next year was given the rank of major-general.

In the Service of Great Britain

He had already, at the request of the British government, visited South Africa, to help check the plague of pneumonia from which thousands of negroes in the mines were dying. After his retirement from the army, in 1918, he was asked again to visit Africa to investigate sanitary conditions in West Africa; but he died in London before this work was finished. General Gorgas had received high honors of all sorts during his life, and after his death the British government took official charge of his funeral in St. Paul's Cathedral, London.

GORILLA. The largest and most manlike of all the apes is the gorilla, a native of the dense forests of central Africa. Gorillas stand and walk erect more frequently than the other apes, which led early explorers to mistake them for savage men. Their bodies are covered with a mixture of gray and brown hair, they have flat noses and very prominent ridges over the eyes, and their facial expression is hideous and brutal. They are very ferocious, but they feed upon berries, sugar cane, and other vegetables. They live in pairs, with their offspring, rather than in troops. Very few civilized persons have seen a live gorilla as they are scarce and difficult to capture and do not live long when taken from their native forests. An old male gorilla which was killed in 1919 stood 5 feet 11 inches in height; measured 58 inches around the chest, 67 inches around the stomach, and 7 feet from tip to tip of his extended arms. Its weight was not stated, but gorillas weighing more than 400 pounds are on record. (*See* Ape.)

A BABY GORILLA

Not an unpleasant face — do you think — for a Gorilla? But he's only a baby. Later he will develop tusklike teeth and a ferocious scowl.

GOTHS. First of the northern barbarians whose successive assaults brought low the might of Rome were the Visigoths or West Goths. Where the Goths first came from is not definitely known. There were stories told by their old men of a time when their people had dwelt far to the north, on the shores and islands of what is now Sweden. Then had come long slow wanderings, through the forests of western Russia, until they reached the shores of the Black Sea. In a hundred years of contact with the Romans, they learned many things, especially the Christian religion.

This was spread among them by the efforts of a convert of their own race, a saintly man named Ulfilas. For more than 40 years he labored, first making a Gothic alphabet into which to translate the Bible, and then teaching his people the new faith. This Bible translated by Ulfilas is centuries older than the earliest writing which we have in any other Teutonic language, so its historial value is very great.

For a time the Goths ruled a great kingdom north of the Danube River and the Black Sea. Then the Huns swept into Europe from Asia, in 375 A.D., conquering the Ostrogoths or East Goths, and forcing the Visigoths to seek refuge across the Danube within the boundaries of the Roman Empire. In a battle fought near the city of Adrianople, in 378, the Visigoths defeated and slew the Emperor Valens. For a time they lived peaceably on Roman territory; then, on the death of the Emperor Theodosius in 395, they rose in rebellion under their ambitious young king Alaric, and overran a large part of the Eastern Empire. Rome itself fell into the hands of the impetuous Goths in 410 (*see* Alaric).

Alaric's successors led their people out of Italy and set up a powerful kingdom in southern Gaul and Spain. In the year 507, the Visigoths in Gaul were defeated by the Franks and were forced beyond the Pyrenees. For 200 years their kingdom in Spain flourished. It did not come to an end until 711, when the Moors crossed over from Africa, and in a terrible eight-day battle destroyed the Visigothic kingdom. (*See* Spain.)

The Ostrogoths for a time formed part of the vast horde which followed the king of the Huns, Attila, settling in the lands south of Vienna when the Hunnish kingdom fell apart. Their national hero was Theodoric the Great, a powerful and romantic figure who became king in 474. When a boy he had been sent as a hostage to Constantinople and had there been educated. In 488 he invaded Italy, with the permission of the emperor at Constantinople. After several years of warfare Theodoric captured and slew Odoacer, a barbarian who had there usurped the Roman power and founded a powerful kingdom, which included all Italy together with lands north and east of the Adriatic Sea. His reign was one of the ablest and best in this period, and his kingdom was one of the great "might-have-beens" of history. He failed largely because no permanent fusion was effected between the barbarians and the Christian-Roman population. All his wise plans for bringing this about proved futile because the Ostrogoths, in common with most of the German barbarians, had been converted to Arianism, an heretical form of Christianity, and so were hated by the orthodox.

After Theodoric's death, in 526, the generals of the Eastern Empire reconquered Italy (*see* Justinian I, Emperor of Eastern Roman Empire). After their last battle (near Mount Vesuvius, in 552) the Ostrogothic nation marched out of Italy, to mingle and merge in other barbarian hordes north of the Alps, and disappeared from history.

GOURDS. Over the back porch or the milk house of an old-fashioned farmhouse a gourd vine is almost sure to be found trailing its downy leaves and pretty white blossoms. In pioneer days this vine was more than a luxuriant climber, for from the hard-skinned thin-fleshed shell of its fruit were made such everyday necessities as dippers, spoons, water-bottles, and other primitive utensils.

The "gourds" or fruits of the various species assume many strange shapes and range from a few inches to five feet in length. One variety grown in America is called the "vegetable sponge" or dishcloth "gourd," because the fibrous character of its interior when dried adapts it for these uses. From the neck of the calabash gourd of South Africa are made pipes highly prized by smokers.

Gourds belong to the family *Cucurbitaceae,* and are distinguished from the closely related pumpkins, squashes, and melons by having white instead of yellow flowers. In Europe the members of these edible species are also popularly known as gourds. The American bottle gourd is *Lagenaria vulgaris.*

GRAIN ELEVATORS. Dotted along the railways in the grain-growing regions of the United States and Canada are thousands of structures, called "elevators," for storing grain and loading it into freight cars. At various central and terminal points are hundreds of larger elevators, to which the grain is brought from the country elevators to be stored until it is needed for milling or export. Nearly all modern elevators are of reinforced concrete, and consist of several huge cylindrical bins like silos. A great cupola at the top contains the machinery and spouts for handling the grain. In the largest plants the machinery is housed in a separate "working house."

The largest elevator in the United States, the Armour Grain Company's elevator at Chicago, has 130 storage bins, 104 feet high and 22 feet in diameter, with a capacity of 4,383,000 bushels. The working house contains in addition 93 bins, 74 feet high and 14 feet in diameter with a capacity of 931,000 bushels, for receiving, shipping, cleaning, drying, and bleaching. At Port Arthur, Canada, the Canadian Northern Railway Company has an elevator with a capacity of 9,000,000 bushels.

Grain is unloaded from the cars and hoisted into the elevators by buckets attached to an endless belt, or is sucked up in huge pneumatic tubes. Sometimes a great steam shovel scoops the grain into hoppers below the tracks, from which it is hoisted in the belt conveyors. In the cupola the grain is discharged through spouts into garners, then into hoppers where it is weighed, and then into the storage bins. If necessary it goes into the cleaning and bleaching bins before it is put into storage.

On the Great Lakes, vessels are loaded by a number of huge spouts, through which the grain pours into the hold at such a rate that the largest vessels are loaded in two or three hours.

Dissatisfaction with marketing conditions under the old system of railroad-owned country elevators has recently led in the West to the building of many coöperatively owned elevators, which now handle a considerable proportion of all grain marketed in the United States. (*See* Wheat.)

TOOLS *of Our* EVERYDAY SPEECH

Rules that Help You to Say in the Best Way what You Mean — Correct English, the Most Widely Accepted "Trade-Mark" of an Educated Person

GRAMMAR. Some people say that the hammer is the commonest tool in the world. Others hold that knives and forks are used more frequently, and others that dishes are still more common. In fact, it is a very interesting game to decide which is the most common of all, especially if by tool we mean anything that people use. But the most common tool of all is one that you would never think of in a year. It is called a "sentence." So interesting is this tool that we shall take a little time to show what it is like, and how to use it. To use it properly is very important, much more important than using a hammer, for instance. If you do not use hammers properly you may hit your thumb or bend the nail or mar the wood, but if you do not use sentences properly,— that is, if you speak or write ungrammatically — people may mistake your meaning in listening to you, or may think that you have not been well taught, or may even think you are a very careless person.

If you take any book, one like this which you are reading, you can easily learn to pick out sentences. We have already written ten of them, including this one sentence. Some of the marks by which you can recognize a sentence are as follows:

First of all, it is necessary to know that a sentence is a group of words expressing a complete thought. For instance, *A dog* is not a sentence, but *A dog bites* is. *Old King Cole* is not a sentence, but *Old King Cole was a merry old soul* is a complete sentence.

Second, a printed or written sentence always begins with a capital letter. This is very important to remember, because many children forget to begin their sentences with capitals, and so do not use this very common tool properly.

Third, at the end of every sentence there is always a period which looks like this (.), or an interrogation mark (?), or an exclamation point (!). It is always a safe rule to put a period at the end of the sentence except when you ask a question, as *Where is my hat?* or when you are very much excited and cry, *The house is on fire!*

The Need for Proper Punctuation

With these last two rules one can go through a book and count the sentences very easily. Suppose you read again the first ten sentences of this article and see if we have counted correctly. But you cannot be sure about these rules in some compositions written by boys and girls, even in the high school. For instance:

"I got my first pair of skates on my seventh birthday they were more fun than anything else I ever had. It began to thaw the day before my birthday. so that I had to wait nearly a week for the river to freeze again before I could try them."

The boy who wrote this wasn't careful to show you where one sentence ended and the next began. The first complete statement ends with the word *birthday*, so he should have put a period after that word and started *they* with a capital letter. He was right in putting a period after *had* and starting the next word with a capital, because the second complete statement ended with *had:* but the next complete statement runs all the way to the end of the paragraph, and so the writer was wrong in putting a period after *birthday*.

Sometimes sentences have what seem like two or more sentences in each, but they are not *exactly* sentences, and so they are called *clauses*. For instance I may say: *I am sick. I ate ice cream.* But it would perhaps be more nearly true to say: *I am sick because I ate ice cream.* Here the two clauses are joined by the word *because*.

The Words that Tie Sentences Together

These words that join sentences are called "conjunctions." It is interesting that they also join words and what are known as phrases. In the sentence, *Jack and Jill went up the hill*, the word *and* is a conjunction joining two other words. And in the sentence, *It is in the kitchen or under the table,* the conjunction *or* joins the two phrases, *in the kitchen* and *under the table*.

The most common conjunction is *and*. This word some people use too frequently, hitching all their ideas together. For instance:

"I awakened early and dressed and found the bait and went fishing and caught eight pickerel and I came home and gave them to mother and she asked me to clean them and she fried them for us and they certainly tasted fine."

This looks like one sentence; but it is not really one, for it would sound much better to break up this long statement and say:

"I awakened and after I had dressed I found the bait and went fishing. I caught eight pickerel. After a while I came home and gave them to mother, who asked me to clean them. Then she fried them for us. They certainly tasted fine."

If you have ever been in a museum you may have seen some of the earliest forms of the common tools which we use today. For instance, the oldest plow is a pointed stick with which the ground was dug up by sticking the point in and prying up the soil. Many improvements were made until we now have great gang plows hitched to tractors run by gasoline.

The same is true of the sentence. Long years ago the sentences we now use were single words. In fact, the first sentences of little children are still single words. A baby gets hungry and cries "Milk," or touches something and says "Hot." What you would say might be, "I want some milk," or "This oatmeal is hot." This is because you use the most improved form of sentences. However, just as it took a long time for people to learn to make our improved plows, so it took many thousands of years for people to work out the improved form of the sentence we now have.

Sentences Only One Word Long

And oddly enough, we all still use a form of sentence which consists of one word. For instance, we say *Ouch! Fire!* or *Oh!* These are called "interjections" because they are words that express strong feeling. It is quite clear that such words are not very definite, because *Ouch!* may mean *I stubbed my toe* or *I hit my finger* or *Tom pinched me.*

But they are very handy tools to use when we are in a hurry and are quite excited about something. If I call *Fire!* people will come, even though they do not know exactly what is on fire or where it is.

Although people first used a single word for a sentence, and little children still do so, as soon as they wanted to be more definite they split the sentence into parts. Instead of saying "hurt!" the little child says "Finger hurts." He has then discovered the two parts to our sentence—"subject" and "predicate." The subject is the thing we talk about—*finger*, in this case, and the predicate indicates what is said about it—*hurts*, the baby says.

Now, all sentences can be divided into these two parts. No matter how long or complicated a sentence may be, this is true. In the sentence "The largest city of South America is Buenos Aires," the subject is not one word, but many. It is, *The largest city of South America.* The predicate is, *is Buenos Aires.*

Nouns that are Common and Nouns that are Not

In the sentence "Finger hurts," *finger* is the name of something, just as city, South America, and Buenos Aires are names of places. These name words are called "nouns." They may name some particular person or place, like *Charlie Chaplin, John, United States, Chicago;* or they may merely name a group or class of things, like *pen, dog, city.* You notice that most nouns begin with small letters but the names of persons and places begin with capital letters. The first of these classes we call "common nouns," and the second "proper nouns."

The Business of the Verbs

If we went about merely saying nouns to one another, we should not be able to make our meaning very clear. If a boy shouted "Baby" to his mother, she would probably think that the baby had fallen into a bucket of hot water, or out of bed. If the boy said "Baby" quietly, his mother would wait for the next word. She would want to know what the baby was doing or in what state or condition he was. If the boy said "Baby walks," the question in her mind would be answered by an "action" word *walks*. If he said "Baby is hungry," the question would be answered by an "existence" word *is*. Such a word doesn't show action; it merely links *baby* and *hungry*. The words which show action and those that link the subject to something said about it are "verbs." *Run, jump, play, eat, sleep, read, write* are all "action verbs." *Is, are, were, have been, will be,* are all "linking verbs."

The Little Substitutes for Nouns

A ten-year-old boy named James in talking to his mother would not say "James is hungry. James wants an apple." He would have noticed that people do not speak of themselves by name but use the words *I, me,* and the like. He would say "*I* am hungry. *I* want an apple." If he were a generous little boy he might say "John is hungry; *he* wants one too." The word *he* would stand for John. These substitute words are called "pronouns" because they are used *for* nouns; and the Latin word meaning "for" is *pro*. *I, he, you, they, them, me, we* are all pronouns.

Adjectives and the Art of Speech

So far we have talked about five of the eight kinds of words, or "parts of speech"—nouns, pronouns, verbs, conjunctions, and interjections. One can build many sentences with only these five kinds of words, but if there were no other parts of speech we should not be able to say many things that we should like to. For example, suppose you had lost a coat and were trying to tell about it so that people would know which coat you meant. If you said "Did you find a coat?" nobody could help you very much, in a large school especially, because perhaps other boys also had lost coats. But if you said, "I lost a *blue* coat," there would be more chance of your finding it. *Blue* adds to the meaning of coat—it describes it. You might have used *large,* or *old,* or *shabby,* or *new,* in place of, or with, *blue*. All these words that add to the meaning of nouns are called "adjectives."

How Adverbs Help the Verbs to Talk

If only one blue coat had turned up at the lost-and-found desk, you might not have much trouble in claiming your own. But suppose that four coats, and four blue coats, were awaiting their owners. You might have to tell other details to the man in charge, the *time* you lost the coat, the *place* in which you left it, or *why* you were so long about claiming it. You might say "I lost a blue coat yesterday in the basement." Then *yesterday* and *in the basement* would tell time and place. They would make the verb *lost* more clear, and would add to its meaning. The coat found in that particular place (*in the basement*) and at the time (*yesterday*) would be identified as yours.

Such words or groups of words that narrow down or add to the meaning of verbs are called "adverbs" or "adverbial phrases." The word adverb is easy to remember because *ad* means "to" or "near." In the sentence "Very heavy clouds rolled quickly across the sky," you will discover a new way of using a helping word, if you look closely. We have had adverbs modifying or changing the meaning of verbs, but now we have a word modifying an adjective. The writer was not satisfied with saying that the clouds were heavy. He added the word *very* to make *heavy* more intense. *Very* is an adverb modifying an adjective. If the writer had wanted to make *quickly* more intense he might have said *very quickly* instead of *very heavy*. In that case the modifying adverb would have helped out the meaning of another adverb. Adverbs, then, may modify verbs, adjectives, or other adverbs. Just as adjectives themselves, they may be single words or groups of words.

How the Prepositions Help Out

In some of the little groups of words used so far, as *in the basement,* there are expressions which have not as yet been explained. In the sentence "I lost my coat in the basement," *in* is a new kind of word. It is a "relation" word; it shows a connection between *lost* and *basement,* but it doesn't mean anything alone. Such words are "prepositions." They show the relation between nouns or pronouns and some other word in the sentence. Thus in "The boy on the fence has a new bat," *on* is a preposition which shows the relation between *boy* and *fence*. These prepositions always have nouns or pronouns for objects.

Only Eight and You Know Them All!

Now you have learned the names of the eight parts of speech and something about each of them. You will be interested to know that all the hundreds of thousands of words in the dictionary belong to one or another of these eight classes. Everything that has ever been thought or written or spoken in the English language has been expressed by grouping together these parts of speech. Uneducated persons often have great difficulty in making others understand just what they want to say, because they do not know enough about words and sentences and how to use them. That is why it is important for you to learn "grammar," which is the study that tells you how to use these valuable tools.

You will find many other interesting and important facts about the parts of speech, and how to use them correctly, if you will turn to the articles in this work under the headings Adjective; Adverb; Conjunction; Noun; Preposition; Pronoun; Sentence; Verb.

How Grammar Helps You to Think

Grammar, as the science of language, has always had an important place in the schools. Three hundred years ago and for a long time after, grammar, especially Latin grammar, held the first place. But with the growth of the common school system grammar dropped into the background. Even in the grades of the common school grammar holds a less important place than formerly. More thoughtful teachers omit formal grammar almost entirely in the first six grades, leaving it to the last year or two of the grammar school.

The general tendency of modern education is to make all studies more concrete and realistic; and, in agreement with this notion, geography, nature study, literature, history, and manual training have gained a more important place in schools, while grammar has lost.

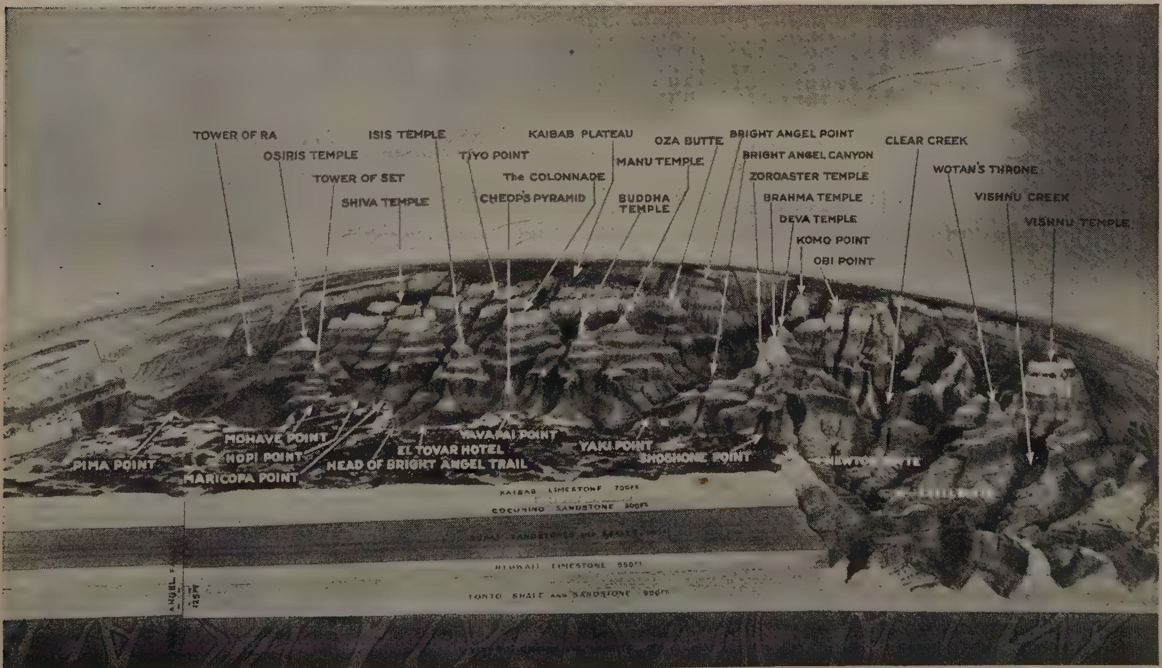
The real value of grammar may be stated thus: All human thought is expressed chiefly through language and, at bottom, the rules of correct thinking are involved in the study of grammar. Correct language is the popular form of logical thinking. To analyze sentences, to examine the structure and arrangement of the parts, to study the various modes of expressing thought and shades of thought grammatically—these activities have always been regarded as the most fundamental and universal method of disciplining the intellectual faculties. In this respect grammar contributes an element of logical accuracy to all studies and lays a basis for correct thinking. The study of grammar also teaches correct usage. Students of more mature years are greatly helped in correcting their faults by insight into the rules of grammar. They learn to criticise themselves and the wrong usages to which they have been accustomed.

The method of teaching grammar has been a subject of much controversy among educators. The older grammars were essentially deductive, proceeding from rules and principles to examples and further applications. Some of the later grammars have emphasized the inductive approach to the rules of grammar. In the inductive method the analysis of sentences is put first. Out of this study of sentences develop later the rules of syntax and the classifications of forms of speech and usages. Some of the more recent grammars have taught the subject in the way indicated above—as a *thought* study, an analysis of the processes of thinking rather than a formal treatment of words and sentences.

Students in the high school, employed in the study of German or French (or it may be Latin or Greek), are believed to receive a grammatical training superior to that given by the study of English. A chief argument for the study of Latin is, first, its linguistic disciplinary training, and second, its reflex influence upon English grammar and speech. Latin has had a great historical influence in determining the development of English speech. It has supplied many words and phrases and has shaped English speech through great writers who were fully saturated with Latin language and Latin style.

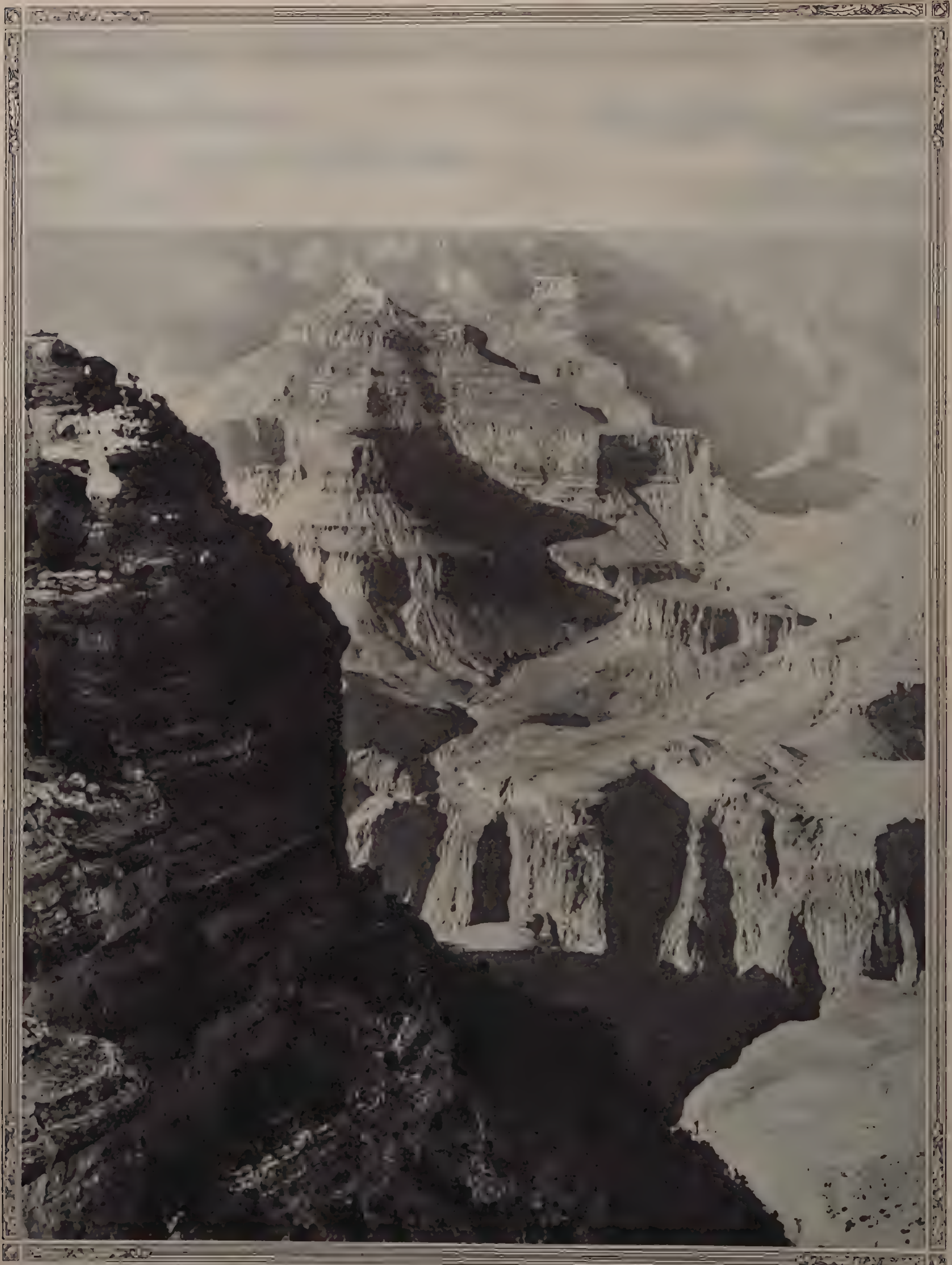
GRAND CANYON. When you stand on the rim of the 200-mile gorge cut by the Colorado River through the high plateau of northern Arizona, you are overwhelmed with awe. The Grand Canyon of the Colorado is the longest and deepest canyon in the world. It is Nature's greatest example of sculpturing.

THE ANCIENT PEAKS AND GORGES OF THE GRAND CANYON



This greatly reduced model brings into one picture the striking array of Nature's sculptures which make up the marvelous show spot of the American Southwest.

THE STUPENDOUS CANYON THAT BAFFLES DESCRIPTION



So stupendous, so incredibly vast and magnificent, is the Grand Canyon, that, as one writer says, "It has swallowed all the words in the dictionary suitable for describing the impression it makes on the eye, and it still remains undescribed." Here we see how the tributaries of the Colorado have cut up the original mass into the "temples" and buttes. Some ledges are red, some yellow, some gray. Purples and blues and greens appear in certain lights. The effect is like a great broken rainbow.

Look across the yawning depths of the stupendous chasm to the opposite wall, ablaze with bands of glowing colors. Peer over the edge, and far below you see what appears to be a tiny silver thread; it is the swift-flowing Colorado, one of the large rivers of North America. It looks so small because it is a mile below you. At the top its canyon is 8 to 12 miles wide.

From the rim to the river's brink the walls descend in a succession of cliffs and terraces, like a giant's staircase, each step several hundred feet high. The barren rocks of white, buff, dull red, and green have been carved into a bewildering variety of forms—buttes and pinnacles, alcoves and "Oriental temples" crowned by battlements.

The majesty of the Grand Canyon, which Charles Dudley Warner called "by far the most sublime of all earthly spectacles," is accentuated by a myriad of side gorges which join the main canyon from right and left. The region is "a composite of hundreds and thousands of gorges." Few have seen more than a tiny fraction of its wonders, for the journey through the length of the gorge is made extremely hazardous by the many rapids, in some of which the stream attains a velocity of 25 miles an hour. The first man to go through the canyon was Major J. W. Powell (1869), later Director of the United States Geological Survey, whose fascinating narrative of his explorations remains one of the classics of American travel.

Even the hardiest frontiersmen shunned the unknown perils of engulfing whirlpools, underground passages,and giant falls which Indian legend attributed to the canyon, until Major Powell organized a party of ten to thread the gorge from end to end. Hazardous enough the adventure proved, though the underground channels and giant falls were found to be myths. On the very day the journey ended, just before Major Powell and the faithful few of his band emerged into safety, four men deserted, hoping to scale the walls, and were never heard from again.

A reservation of 800,000 acres along the border of the Grand Canyon has been set aside by the United States government as one of the national monuments. A railroad spur runs to the most accessible part of the canyon, and hotels have been built on its brink. Thousands of visitors every year take the four-hour trip down trails to the bottom.

GRAND RAPIDS, MICH. When an American thinks of furniture he thinks of Grand Rapids, "the furniture capital of the United States." About 75 furniture factories are located there, and the annual output is enormous. While New York and Chicago exceed Grand Rapids in the volume of production of furniture, Grand Rapids is regarded as the leader in design, finish, and quality.

Twice a year furniture buyers from all parts of the United States and even from abroad come to this city to inspect new styles and place orders. These events have become so important that manufacturers from other cities also send their products to be displayed in huge exposition buildings erected for their use.

Grand Rapids is the metropolis of western Michigan and the second city of the state in population and importance. It is located about 35 miles from Lake Michigan, and is built on both sides of the Grand River, which affords steamboat connection with the lake ports. Though furniture-making is its chief industry, Grand Rapids is not by any means a one-industry town. It has metal-working concerns, machine shops, clothing and shoe factories, knitting mills, textile industries, paper mills, tanneries, and flour and feed mills. Much plaster is made from its rich gypsum beds under and near the Grand River. Grand Rapids supplies the world with carpet-sweepers and sticky fly paper. It is in the center of the famous Michigan fruit belt, and is one of the greatest peach markets in the world.

The city, which has followed a definite plan of city building, is very attractive. The park and playgrounds system includes more than 200 acres.

In 1826 an Indian trading station was established on the site, and the first permanent settlement was made in 1844, by the Dexter Colony from Herkimer County, N.Y. Grand Rapids was incorporated as a village in 1838 and as a city in 1850. It adopted the commission manager plan of government in 1917. Population, about 140,000.

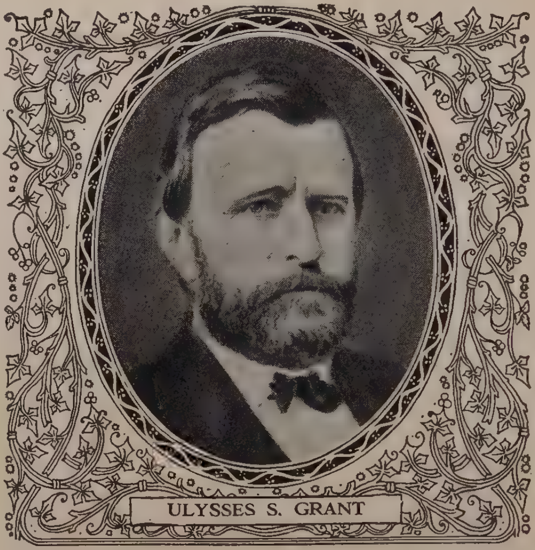
GRANITE. If you look closely at a piece of granite you will see that it is made up of more than one kind of material, and if you crush it to powder you can easily pick out tiny fragments of the separate substances, or minerals, that compose it. The chief minerals are quartz, feldspar, and mica. The color of granite depends on the proportions and varieties of the minerals present. The prevailing color is gray,—light gray if dark minerals are few, dark gray if they are abundant. Greenish, pink, and red hues are due to different kinds of feldspar.

Granite belongs to the group of "igneous" rocks—that is, it was formed ages ago by the cooling of liquid lava. This cooling took place far below the earth's surface and very slowly, thus giving plenty of time for the formation of crystals. Granite belongs to no particular geological age, but was formed in all periods and may be forming now far below the earth's crust. It is one of the most widely distributed of rocks, occurring in the United States mainly in mountainous regions.

Fresh granite is a very hard stone, but like other rocks it may decay and crumble to pieces. Because of its great hardness it is difficult to work, and so is an expensive building stone. It is used chiefly for paving blocks, for monuments, and for large buildings, where great strength and durability or beauty of finish are required. Many of the varieties are exceedingly beautiful in coloring and take a high polish.

The hills and mountains of New England supply us with much of our granite; Vermont, Massachusetts, New Hampshire, and Maine being large producers. Other important quarries are found in North Carolina, Minnesota, Wisconsin, and California.

The HERO *of* APPOMATTOX, *in* WAR *and in* PEACE



ULYSSES S. GRANT

GRANT, GEN. ULYSSES S. (1822–1885). When the news that Fort Sumter had been fired on was flashed over the wires, in April 1861, meetings were held in every city and village in the North, and volunteers by thousands offered their services in defense of the Union, even before President Lincoln issued his first call for troops. At a meeting in Galena, Ill., a middle-aged clerk in the hardware and leather store of Jesse Grant came forward and offered to help recruit a regiment. This man was Ulysses S. Grant, a graduate of West Point, who had served with distinction in the Mexican War and had resigned from the regular army with the rank of captain.

Born on April 27, 1822, on a farm near Point Pleasant, Ohio, the boy was named Hiram Ulysses. An error in his papers when he entered West Point Military Academy in 1839 dropped the Hiram and inserted Simpson, his mother's maiden name. He reported the error, but it was never corrected, and eventually he adopted the name as changed. But his son, U. S. Grant, Jr., reports that the "S" was always written without a period, and that while it may have meant "Simpson," it was never so written.

Upon his graduation in 1843, Lieutenant Grant was sent to Jefferson Barracks, Mo., and thence to the Mexican War, where he won two brevets for bravery. In 1848 he married Julia B. Dent, the sister of a classmate, in St. Louis, and saw several years' service in the Far West in pioneer days. In 1854 he resigned and retired to a farm near St. Louis, later opening a real-estate office in the city. But in business Grant was a failure. He got into debt, and was glad to take a place as clerk in his father's store in Galena.

A Man of the Bull-Dog Breed

In May 1861, Grant was appointed colonel of the 21st Illinois Infantry, and in August he was made brigadier-general of volunteers and given command of southwestern Missouri, with headquarters at Cairo. From the start Grant's policy showed the aggressiveness which marked his whole career. He at once took possession of Paducah, Ky. On November 1 he routed the Confederate garrison at Belmont, Mo., a result which checked the advance of a Confederate force under General Price. In February 1862, he captured Fort Henry on the Tennessee and Fort Donelson on the Cumberland. While he was besieging the latter the commander of the fort, General Buckner, asked for terms of capitulation, to which General Grant replied: "No terms other than an unconditional and immediate surrender can be accepted." Buckner surrendered the fort with over 14,000 prisoners, and Grant became famous as "Unconditional Surrender" Grant. This important victory broke the Confederate lines, and secured Federal control of western Kentucky and Tennessee.

Grant was now made major-general of volunteers and given command of western Tennessee. On April 6 he fought the battle of Shiloh, one of the bloodiest engagements of the war. He was severely blamed by the people of the North for the heavy loss of life in this battle, and many demanded his removal from command. But President Lincoln steadily upheld him, saying, "I can't spare this man, he fights." During the summer he fought the minor battles of Iuka and Corinth.

Then Came the Fall of Vicksburg

He then turned to the capture of Vicksburg, which would open the Mississippi River. His first advance on the city, poorly planned and complicated by political intrigues, proved a failure. But Grant remained in the neighborhood with his army, and after trying one plan after another without result, his perseverance was at length rewarded. After a daring campaign, in which his generalship and his energy were more conspicuous than ever, he besieged the city, and at the end of six weeks this stronghold, with its garrison of 32,000 men, was surrendered (July 4, 1863).

Grant's next campaign was for the relief of Chattanooga, where the Federal army, beaten at Chickamauga, was besieged and practically cut off from supplies. On November 23 to 25 the battles of Lookout Mountain and Missionary Ridge were fought, resulting in the defeat of the Confederates.

In March 1864 Grant was made lieutenant-general and placed in command of all the Union armies. He now planned a wide campaign which should press the Confederates simultaneously at all points east and west. Leaving Sherman to fight Johnston from Chattanooga to Atlanta, he himself with the Army of the Potomac confronted the Confederates under General Lee. The clash of these great leaders came in the terrible battles of the Wilderness, Spottsylvania, North Anna, and Cold Harbor. Finally came the siege of Petersburg, which ended in its fall, the capture of Richmond, and the surrender of Lee at Appomattox, April 9, 1865. Grant's generous terms of surrender and his courteous treatment of his late foe won the heart of the South. At a later time he even threatened to resign his command if President Johnson had Lee tried for treason.

The war was over. Grant went immediately to Washington to hasten the disbanding of the army. He was created general, a higher rank than had hitherto existed in the army, and was hailed as "the man of destiny" and "the nation's deliverer." As such, he was elected president in 1868 on the Republican ticket, with Schuyler Colfax of Indiana as vice-presidential candidate, against Gov. Horatio Seymour of New York, the Democratic candidate.

"The man on horseback" is not always a successful executive. General Grant's inexperience in civil administration was conceded and his lack of political ability was soon to be shown. But his strong will was known and also his rugged patriotism. He possessed the confidence of the people, and this was increased by the negotiation of the Washington treaty with England, which defined the rights and duties of neutral nations in time of war and arranged the arbitration of the *Alabama* claims. His attempts failed, however, to bring about the annexation of Santo Domingo to the United States.

GRANT'S ADMINISTRATIONS
1869–1877

Treaty to annex Santo Domingo defeated (1869).
15th Amendment enfranchising Negroes ratified (1870).
Last of seceded states restored (1870).
'Alabama' Claims referred to arbitration (1871).
Amnesty Act for ex-Confederates passed (1872).
Great fires in Chicago (1871) **and Boston** (1872).
Panic of 1873.
Bill to increase paper money vetoed (1873).
"Salary Grab" raises Congressmen's salaries (1873).
Postal cards first issued (1873).
"Whisky Ring" scandal exposed (1874).
Custer Indian Massacre (1876).
Colorado admitted (1876).
Centennial Exposition at Philadelphia (1876).
Disputed Election of 1876.

The most important domestic problem of Grant's administration was the completion of the reconstruction of the South and the adoption of the 15th amendment.

In 1872 President Grant was overwhelmingly reëlected, with Henry Wilson of Massachusetts as his running mate, in spite of the opposition candidacy of Horace Greeley, the noted editor of the New York *Tribune*, who ran on a Liberal Republican platform. At the beginning of his second administration Grant had to face the financial crisis of '73. Here he rendered an inestimable service to the country by vetoing a bill for issuing more "greenback" paper money, and by recommending that the government "resume specie payments" by redeeming its greenbacks in gold. The coinage bill passed the same year was later denounced as the "crime of 1873," because, by dropping the silver dollar from the list of standard silver coins, it "demonetized silver." His policy, however, was unquestionably in line with the best interests of the country.

The last years of Grant's presidency covered the lowest ebb ever reached in the political life of the country. High public officials allowed contractors to cheat the government out of millions of dollars, and themselves profited by the bribes given them. There were grave scandals connected with government aid to the Union Pacific Railway, and the phrases "Credit Mobilier," "Whisky Ring," and "Star Route," became synonyms for dishonesty. But in all the political corruption and scandal, no one imputed personal dishonesty to the President. He was unfamiliar with the intricacies of business and finance. His fault lay only in trusting those who were unworthy of trust and in trying to protect his friends.

In 1877, after his retirement from the presidency, General Grant made his famous tour of the world, in which Occident and Orient competed to do him honor. The attempt to secure for Grant the Republican nomination in 1880 for a third term failed in spite of strenuous efforts put forth by the "stalwart" Republicans.

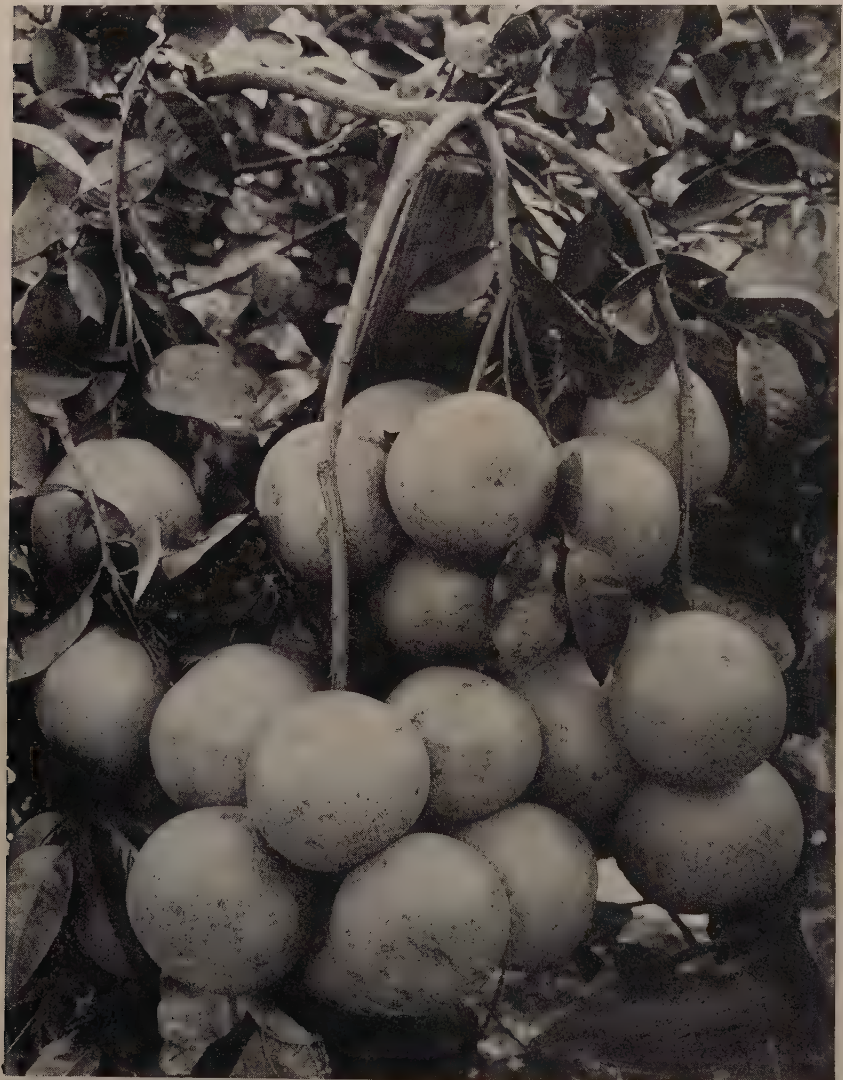
At the age of 56, a man of established fame, Grant invested his capital in the banking firm of Grant and Ward, New York City. With his usual trust in his associates and his ignorance of business, General Grant left the conduct of the enterprise to his partners, who proved dishonest. Through their dishonesty the firm failed, and Grant was left penniless. A fall had crippled him, so that, at this time and until his death, he had to use a crutch.

Nothing in all the career of this great American is so heroic as the closing year of his life. Bankrupt, crippled, dying of cancer of the tongue, he dictated two volumes of 'Memoirs' to provide for his family. When it was absolute agony to speak, with a fortitude and unselfishness that have few parallels in history, he continued his task, completing the work only four days before his death, at Mt. McGregor, near Saratoga, N.Y., on July 23, 1885. Even as literature the 'Memoirs' have a singular merit, on account of their clear, straightforward style. The magnificent tomb erected to Grant's memory in Riverside Park, New York City, is the tribute of a grateful nation to the man to whom was chiefly due the military successes which preserved the Union.

GRAPEFRUIT. Did you ever wonder why a fruit as large as a croquet ball should be called a "grapefruit?" The answer is evident when you walk through a grapefruit orchard in the southern parts of Florida or California during the bearing season. You will see the heavy fruit hanging in grapelike clusters of from three to 18, weighing down limbs and tree until they must be propped up.

The grapefruit belongs to the same species of the citrus family as the shaddock, a coarse bitter pear-shaped fruit weighing from 10 to 20 pounds, which is a native of the Malay Archipelago and the South Sea Islands. The best varieties of grapefruit are about twice the size of a large orange.

A LUSCIOUS CLUSTER OF GOLDEN GRAPEFRUIT



Isn't it strange that although this delicious fruit came to America with the Spaniards several centuries ago, we only began eating it in recent years? Meanwhile how many thousands of these golden globes rotted in the sun, because people didn't realize how good they were!

The grapefruit (also called pomelo) has an interesting history. Only since the early part of the 20th century has it been marketed to any extent, although it was brought to the West Indies and Florida by the Spaniards along with the orange and lemon. The tree is very beautiful, with dark glossy leaves, downy white beneath, and large sweet-scented blossoms which are succeeded by the great clusters of lemon-yellow fruit. The tree was long cultivated in Florida gardens for show. Its fruit was considered refreshing and tonic, but it did not enter the minds of the growers that it had a commercial value. So the ground beneath the trees, after the fruit had ripened, was covered with the great juicy yellow balls, left to rot in the sun.

Northern visitors to Florida learned to like the grapefruit and wanted it on their return, and in this way a certain demand was created for it. Between 1880 and 1885 the first shipment was sent to New York and Philadelphia, and a market was established, at first slowly, then more rapidly.

In no place in the world has the culture of grapefruit reached such perfection as in Florida, and it now constitutes a very important crop in that state. The groves near Miami are one of the sights for winter visitors. Its cultivation has been extended also to California, Jamaica, and Cuba.

As a breakfast fruit grapefruit has no rival. It is an excellent appetizer and its characteristic flavor, which is an indescribable blending of sweet, sour, and bitter, is most pleasant. There are several varieties, the best known being Duncan, Marsh seedless, and Walters.

The tree is small, growing to a height of only about 25 feet, and is less susceptible than the orange to pests and diseases. It is more susceptible than oranges or lemons, however, to an infectious disease called citrous canker. The infection causes scabs to appear on the leaves and fruit.

The grapefruit is usually budded on its own stock or on the sour orange. The tree is a heavy bearer and bears as early as the orange—in about six years—but it is more easily injured by cold, and is grown only in the southern parts of Florida and the warmer portions of California. Scientific name, *Citrus decumana.*

The FRUIT *of the* VINE *and Its* STORY

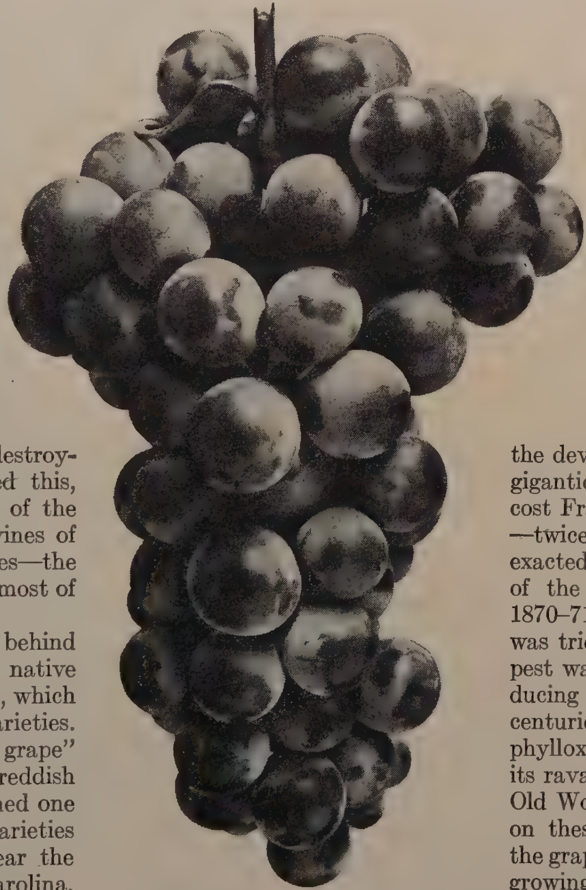
How All Our Purple Concords Came from a Single Seed—Why the Famous French Vines Have American Roots—Grape Seeds that Are 3,000 Years Old

GRAPES. Until a little more than a hundred years ago, the only grapes grown in the eastern United States were the little sour wild grapes you so often see growing in the woods. All the delicious varieties of the eastern United States today, from the tiny reddish Delaware to the great yellow-white Scuppernong, have been developed by careful selection and cultivation from these wild grapes; and most of them have come from one species,—the fox grape.

Take the fascinating story of the rich purple Concord grape, for example. In the year 1840 some boys of Concord, Mass., spent a glorious day gathering wild grapes in the nearby woods. On their way home they threw some of the seeds on the land of Ephraim Bull. Mr. Bull preserved one of the seedlings that sprang up, and three years later when it fruited he planted its seeds. One of the second generation of plants proved much superior to the others, so he destroyed the rest and preserved this, which became the parent of the countless Concord grape-vines of the eastern United States—the kind that supplies us with most of our table grapes.

A story much like this is behind all the other luscious native grapes of the United States, which now include about 800 varieties. The first "truly American grape" was the small sweet reddish Catawba, which has remained one of the most highly prized varieties ever since its discovery near the Catawba River in North Carolina, in 1802. The fine-flavored Isabella and Delaware were also among the earliest native American varieties to be developed.

A MIRACLE OF PLANT TRAINING



No more striking example of the wonders of horticulture can be found than the development of such grapes as this from the little sour wild grapes of the woods. Under man's care, these fruits of the vine have grown sweet and swelled so in size that they crowd one another on their stem.

While the United States has more than two dozen kinds of wild grapes, nearly all the 1,500 varieties developed in the Old World, through thousands of years of cultivation, come from one parent stock. But if you visit the famous vineyards of France you will find that many of them consist of European vines grafted on the root of some American vine. And thereby hangs another of the interesting stories connected with the work of grape culture.

When the early settlers came to the eastern coast of America they brought with them cuttings from the grape-vines of Europe, but the plants all died. It was not until more than two centuries later that scientists discovered that this was due to the ravages of an insect pest, the grape phylloxera, which sucks the sap from the roots of the vines (*see* Aphids). This insect multiplies with such terrific rapidity that a single mother, after laying her eggs in March, might have 25,000,000 descendants by October if they all survived. In 1860 some of these deadly pests were carried to France on American vines with which French growers were experimenting. In a few years the whole grape industry of France was threatened with destruction. By 1888 the devastations had reached such gigantic proportions that it had cost France two billions of dollars—twice as much as the indemnity exacted by Germany at the close of the Franco-Prussian War of 1870–71. Remedy after remedy was tried with little success. The pest was finally checked by introducing American vines, which centuries of exposure to the phylloxera have made immune to its ravages. The various famous Old World varieties were grafted on these American roots, so that the grape remains the same though growing on a different root. Similar measures have been adopted, though to a less extent, in nearly all the vine-growing countries of the world.

Even on the Pacific coast of the United States, where the phylloxera was formerly unknown, it has been necessary to replace many vineyards with European vines grafted on American stocks. In California, which produces about three-fourths of the entire American crop, the common European grape has thrived ever since the days of the Spanish missions, and from it many new delicious varieties have been developed. Among the best known are the Flame Tokay, Emperor, Cornichon, Muscat, and Thompson's Seedless. Some of the California crop is shipped as table grapes to various parts of the United States, but most is used for making beverages, for canning, for jams and jellies, and for raisins (*see* Raisins).

Grapes have furnished men with food and drink since the dawn of history. Grape-seeds have been found with mummies in Egyptian tombs at least 3,000 years old, and it is believed that the grape was the first fruit to be cultivated. The original home of the vine was Asia, whence it was brought to Europe probably by the Phoenicians.

The distinctive colors of grapes are entirely in the outer skin, which may be green, red, yellow, purple, or even variegated. Sometimes grape-vines remain fruitful for 300 or 400 years.

Wines are made by fermenting the juice of the grape. During fermentation a grayish or reddish crust forms in the vat, and this crystalline substance, "argol," refined becomes the "cream of tartar" used in medicine, in effervescent drinks, and in baking powders.

The chief grape-growing districts in the United States, outside California, are the Hudson River valley, the lake regions of central and western New York, northern Ohio, southern Michigan, and the Ozark region of Missouri. The great bulk of the eastern crop consists of three varieties—the Concord, Catawba, and Delaware. (*See also* Currants).

Scientific name of European grape, *Vitis vinifera;* American fox grape, *Vitis labrusca.*

GRAPHITE. In appearance graphite is so different from the diamond that it is at first difficult to believe that the black opaque soft graphite is chemically identical with the colorless transparent precious stone, the hardest of all known substances. But, like the diamond and coal, graphite is one of the many forms in which the extremely useful element carbon is found.

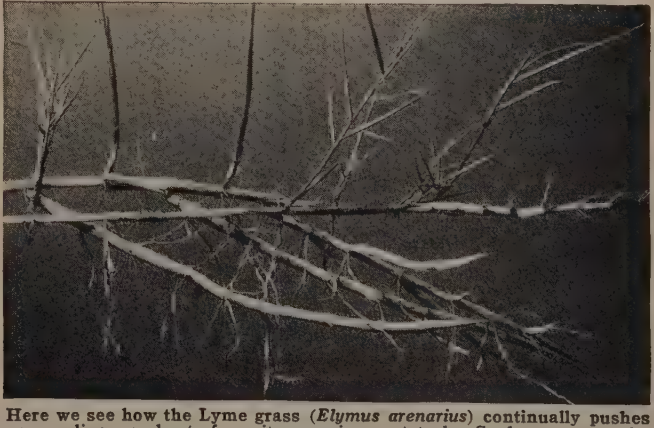
One of the familiar uses of graphite is for the "leads" of black pencils. Because it is a good conductor of electricity it is also much used in electrotyping and electrical apparatus. Graphite makes an excellent lubricant, since the countless minute flakes of which it consists easily adhere to rough metal, producing a smooth surface and reducing friction. But most of the world's production is used with clay and sand to make the crucibles and retorts which do not melt under the most intense heat. Other important uses are for paints and stove polish.

Graphite of the highest purity is now artificially made in electric furnaces at Niagara Falls, N.Y., where the annual production is more than 13,000,000 pounds. Ceylon is the world's largest producer of mined graphite. Madagascar, Korea, Italy, Mexico, and the United States also produce important quantities. The principal sources of supply of "amorphous" or soft graphite in the United States are Colorado, Michigan, Nevada, and Rhode Island. Of crystalline graphite, the most important variety, the United States imports more than it produces, though this form also is mined in Alabama, Alaska, California, Montana, New York, Pennsylvania, and Texas.

GRASSES. There is a fable of a magic carpet that carries one to wealth and the world's wonders. Grasses—the most important and useful family of the whole vegetable kingdom—are such a magic carpet for earth's surface. Wild and cultivated they are the greatest contributors to the needs of human and animal life. A large portion of our food is provided by cultivated "grasses"—wheat, oats, rye, barley, rice, corn, sorghums, and sugar cane; and from grasslands in the ordinary sense come our beef and mutton, hides and wool.

Grasses are the most widely distributed of all the plant families. Pigmy grasses, mosslike grasses not over two inches high, cling close to the cold ground right up to the borders of the field of ice and snow. The giants of the family are the bamboos growing 100 feet tall in the burning heat of the tropics, and other tall species form the impenetrable "canebrakes" of the South where many fishpoles grow. Such "reeds," as they are often called, are used in furniture making, especially in "cane"-seated chairs. Small and middle-sized grasses, growing in greatest luxuriance in the north temperate zone, increase the total of the family to over 4,000 species. In the United States alone there are over 1,000 species, and there may be as many as a dozen in one dooryard. Grasses grow, or can be made to grow, on all kinds of soil and in all sorts of conditions. They thrive on the banks of streams, along the seashore, in the low wet marshlands, on the sunny meadows, or in the shade of woodland and orchard. Some varieties, such as the sweet vernal grass, June grass, and orchard grass, are the first out of bed in the spring; others, like timothy, redtop, and

STURDY PIONEERS OF THE GRASS FAMILY



Here we see how the Lyme grass (*Elymus arenarius*) continually pushes on, sending up shoots from its creeping rootstock. Such grasses make their way along sandy seacoasts, binding the sand together, and preparing the soil to receive less sturdy vegetation.

hair grass, flourish in midsummer; and even fall has its grasses—the beard grass and the dropseed grasses of September.

The grasses can boast of their long ancestry, for they belong to one of the "first families" of the Vegetable Kingdom. As far back as history can go, grasses were growing in abundance. Just as today, they were among the first of plants to cover waste or barren ground and reclaim a neglected roadway or field.

One of the most important things grasses do is to bind down the soil until plants of larger and slower growth can establish themselves, and even then the grasses protect the roots of trees and our fences, roads, and buildings by forming a thick enduring carpet which prevents the wind and rain from carrying away their soil foundation or from blotting them out and burying them under shifting sands. In winter the grasses, changed from their beautiful green to colors of gold and brown, give protection to the seeds and tender bulbs during their long sleep under the snow.

The World's Greatest Pasture-Lands

The great natural pasture-lands of the world are the steppes of Russia, the pampas of South America, the vast plains of America, and the wide ranges or "runs" of Australia. Practically every farm has its pasture-land and the reason is easily understood. Fattening beef cattle, which would cost 20 cents on a ration of grain and roughage, costs only three or four cents a pound on pasture-land, and a cow pastured at a cost of three to five cents a day will give as much milk as when fed on grain and hay at three or four times the cost.

Grasslands of greatest perfection are lawns, especially the lawns of England and other old countries where they have been rolled, trimmed, and regularly watered for centuries. Lawn or pasture grasses have leaves that grow constantly from their bases so that when they are grazed or clipped they quickly grow up again. There are a number of ornamental grasses such as the ribbon-grasses, plume grass, Ravenna grass, Job's tears, and the tall plumed Argentine pampas.

Winners in the Race of Life

Grasses are well fitted for making their own way in the world, and if for any reason they are not wanted they become a most persistent weed, like the blue grass and quack grass which are among the worst weeds of our fields. Numerous are the devices for spreading their seeds, and grass plants are multiplied many times by growths from stolons or stems running along the ground, underground stems, and multiplying bulbs. Grasses are rapid growers, the larger species growing two or three feet and even more in 24 hours, and the 100-foot bamboos grow in from two to three months' time. Another special advantage which many of the grasses have is a peculiar structure of their leaves which protects them from drouth. Thin-walled cells between the veins of the leaves keep them expanded under normal conditions but roll them up to prevent evaporation while drouth and hot winds threaten.

The botanical name of the grass family is the *Gramineae.* The plants are monocotyledonous, and their chief characteristics are the jointed stems with leaves arranged in two opposite rows, a single leaf at each joint of the stem. The stems are hollow except in corn, sorghum, and a few other varieties which have stems filled with soft pith. The leaf is a long narrow blade with its base inclosed in a sheath out of which it grows. The flowers are inclosed in glumes or chaff-like scales and are arranged in spikes like the wheatheads or in panicles like the oat. They depend upon the wind to scatter their pollen and do not have color or perfume to attract pollen-carrying insects. Clovers, alfalfa, and other plants which are grazed or cut for hay are often called grasses, although they are not true grasses.

GRASSHOPPER. If a boy could jump as far for his size as a grasshopper, he could easily spring to the roof of an eight-story building, or cover a long city block in two comfortable leaps. If he could make as much noise for his size as a grasshopper, the ground would tremble with the sound, and if he could eat as much and as fast as a grasshopper, he'd have to dine upon apple pies the size of cart-wheels.

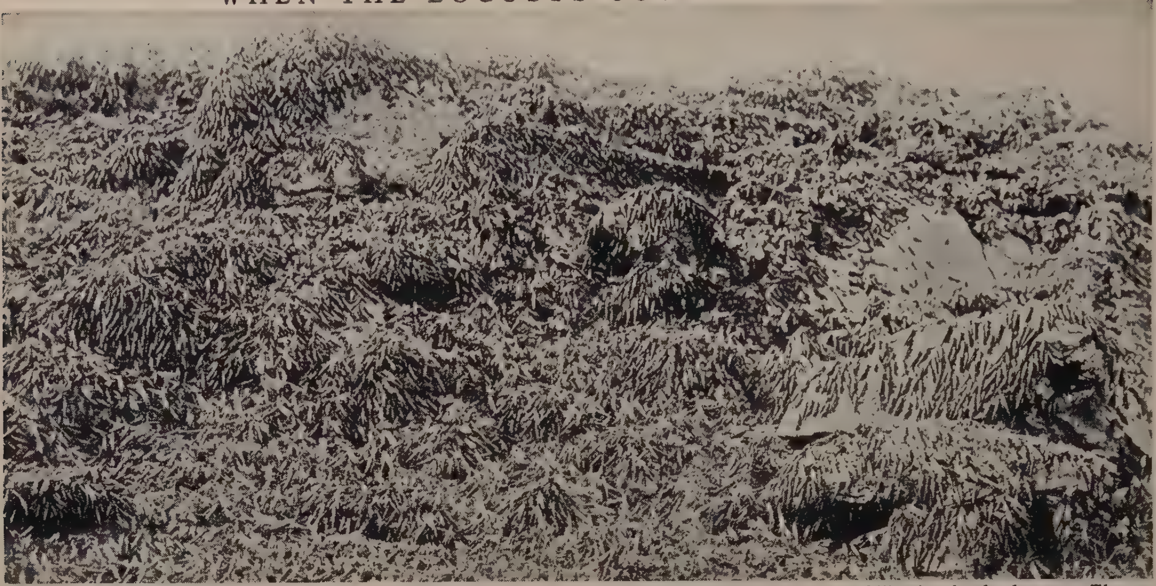
But, if a boy had all these extraordinary powers, it is to be hoped he would make better use of them than his long-legged model. As we learn from the fable of 'The Grasshopper and the Ant', this foolish insect does no useful work, lays by nothing for the future, and wastes its time in tuneless song. In addition to these shortcomings, it has a greedy appetite for most of the things men grow in their fields and gardens. So it is classed as a pest, and has no friends except the birds and fish that feed upon it.

THE BEGINNING OF AN IDLE CAREER

This is a much magnified view of a young King Grasshopper, just starting out in life. While he probably hasn't done much harm so far, it is very much to be feared he will follow the old family traditions of the grasshoppers and spend his days buzzing in the sunshine or devouring the farmer's crops.

Everyone is familiar with the small green variety of grasshopper, which, as the name indicates, is usually found hopping aimlessly in the grass. With a quick hand they are easily caught, but if not held

WHEN THE LOCUSTS COVER THE LAND



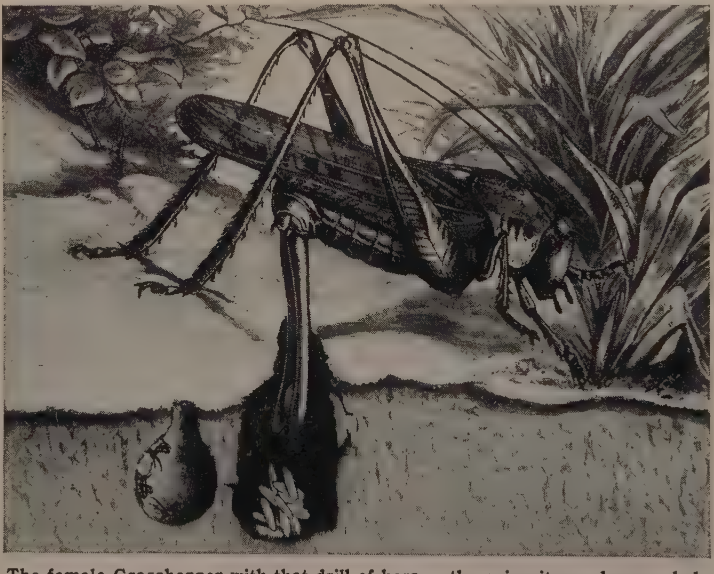
Three hours before the picture was taken this field of wheat in the Transvaal, South Africa, was billowing in the breeze. Then a cloud of locusts appeared on the horizon, spread until the sun was darkened, and the air was filled with the humming of their wings. They settled down on field after field, covering them like living blankets, as you see in this picture, and the wheat was mowed down by millions upon millions of hungry jaws.

tightly will kick themselves loose with those powerful high-angled back legs. At the lower side of their helmet-shaped heads are the strong jaws with which they tear big pieces out of leaves or plant stems. When annoyed they will often spit out a brown liquid. Their front wings, which are tough and hard, lie straight along their backs, protecting the tender film of the back wings.

The reason the grasshopper can't "sing" while you're holding it is that its "voice" is under its front wings, which it rubs against its body when it wants to be heard. Also, don't look for the grasshopper's ears on its head; they are on its front legs below the first joint.

Now imagine a grasshopper nearly four times as large as this one, with legs, jaws, and wings in proportion, and you will realize what the dreaded locust of Asia and Africa is like. This name "locust" is often improperly applied to the cicada, and to other swarm insects, but it properly belongs only to members of the grasshopper family.

MOTHER GRASSHOPPER LAYING HER EGGS

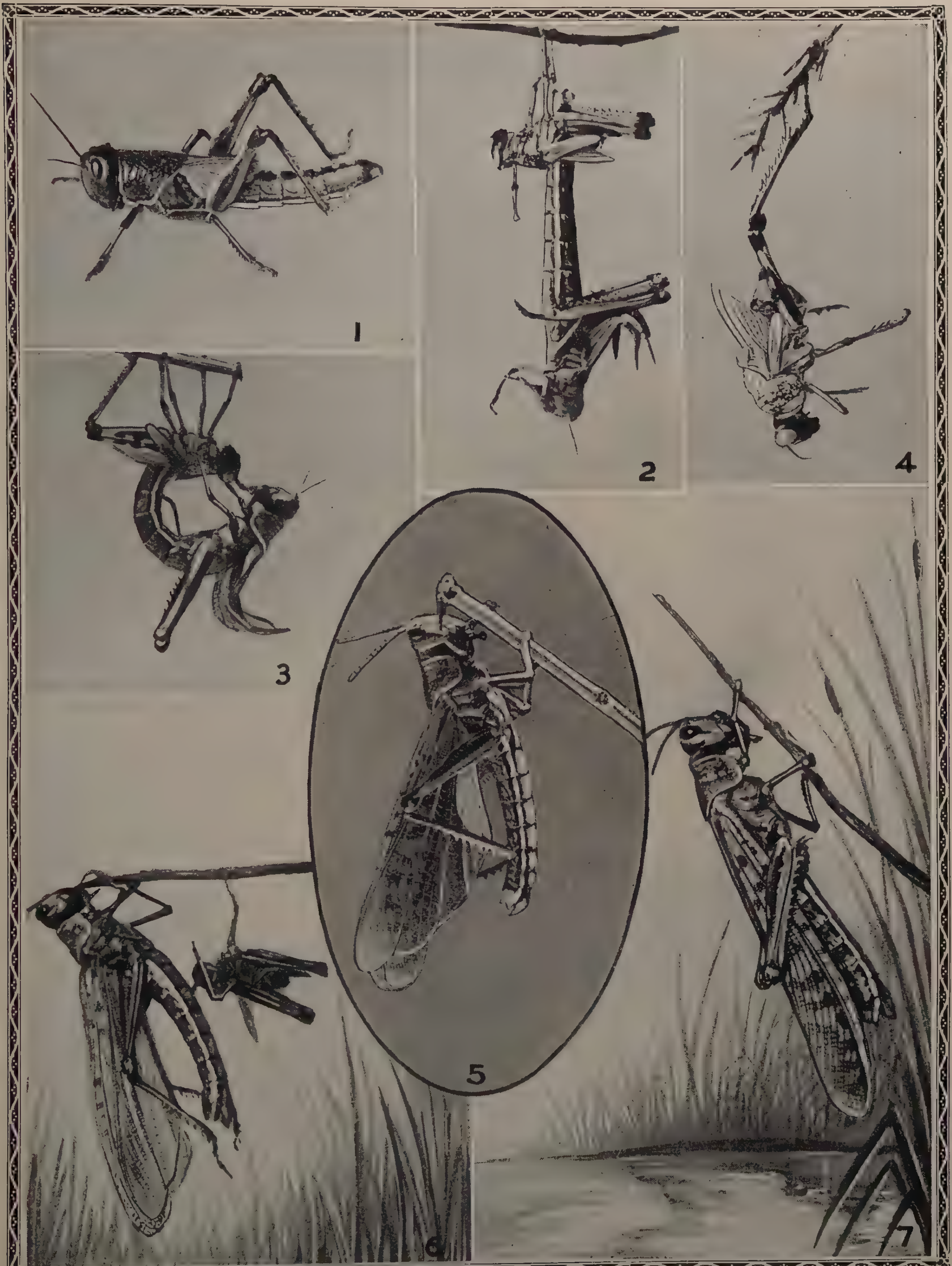


The female Grasshopper with that drill of hers — the ovipositor — bores a hole in the ground sometimes four inches deep. There she lays her eggs. In the hole at the left the eggs have hatched and the young are crawling out. At first, they look not unlike large ants and they spend the two weeks or so before their wings come out eating enormously. The long ovipositor, as well as the long antennae, serve to distinguish the true grasshoppers from the locusts.

A swarm of locusts which devoured the grain and left famine in its wake was one of the "seven plagues" of Egypt, told of in the Bible. Well, the descendants of those same locusts are still alive today.

It is impossible to give an idea of the billions upon billions of locusts which sometimes travel in these swarms. A cloud appears on the horizon like a black storm; it spreads until the light of the sun dies out; the air is filled with the deafening roar of countless wings. The inhabitants rush from their huts and raise their hands to heaven, praying the cloud will pass. But it settles down like a vast blanket, burying every-

HOW THE LOCUST GETS ITS WINGS



1. The young Locust, a few days after hatching, its wings folded inside little cases on its back. 2. Shedding its "nymph" skin. 3. Almost out of the shell. 4. The old shell left hanging to a twig. 5 and 6. The locust drying and smoothing out its wings. 7. Resting after its first trial flight.

thing in sight, blotting out the landscape—for miles upon miles, nothing but a sea of locusts. Then the fatal march of the insect army begins. Before it stretch green fields; the dense column moves forward, and the green fields vanish. Behind the locusts, the ground looks as if it had been swept clean with a vast broom—not a spear of grass, nothing. A river bars the way. The front ranks fearlessly cast themselves upon the water, clinging together, pile upon pile, until a bridge of living insects forms, and the rear ranks march on to their work of destruction.

Mystery of the Locust Plagues

There is mystery in these swarms. They do not come every year, nor do they always attack the same region. No one knows what instinct moves them to these sinister travels, nor where they intend to go. Swarms have settled upon ships 1,200 miles at sea.

In the United States the smaller Rocky Mountain locusts are the chief pest of the grasshopper family. Born in the mountain regions of the West, they descend in swarms upon the fertile plains of the central states, doing immense damage. The names "locust" and "grasshopper" are freely interchanged in popular usage between almost all members of the grasshopper family. But scientists make a distinction between the "long-horned" and the "short-horned" varieties.

The swarm locusts just described belong to the short-horned group, which includes also the brown field grasshopper with the stout red legs. The common green grasshopper, however, has long thread-like feelers and belongs to the long-horned group. The short-horned grasshoppers are also distinguished by having the noise-making apparatus between the hind legs and the wings, and the ears on the sides of the stomach, just behind the chest or thorax.

Where Grasshoppers Lay Their Eggs

Grasshoppers usually lay their eggs in holes which the females bore in the ground. When the young hatch, they look like tiny awkward models of their parents, except that their wings do not develop for some time. Their appetite, however, is large and they start at once their destructive feeding.

Many locusts seem to require a sandy desert soil for laying their numerous eggs, so that, fortunately, the more pernicious varieties tend to disappear with the advance of civilization. In ancient times locusts were often eaten by Asiatic and African peoples, and the custom still survives among certain desert tribes. The insects are usually roasted or baked, and then ground into a powder, which is mixed with flour for bread.

Scientific name of grasshopper order, *Orthoptera*. By a freak of insect classification, the name *Locustidae* has come to be applied to the long-horned variety, such as the small green grasshopper, while those commonly called locusts belong to the group named *Acridiidae*. Scientific name of Rocky Mountain locust, *Melanoplus spretus;* common green grasshopper, *Locusta viridissima*. The common katydid is also a member of the grasshopper family. (*See* Katydid.)

The FORCE *that Holds the* UNIVERSE TOGETHER

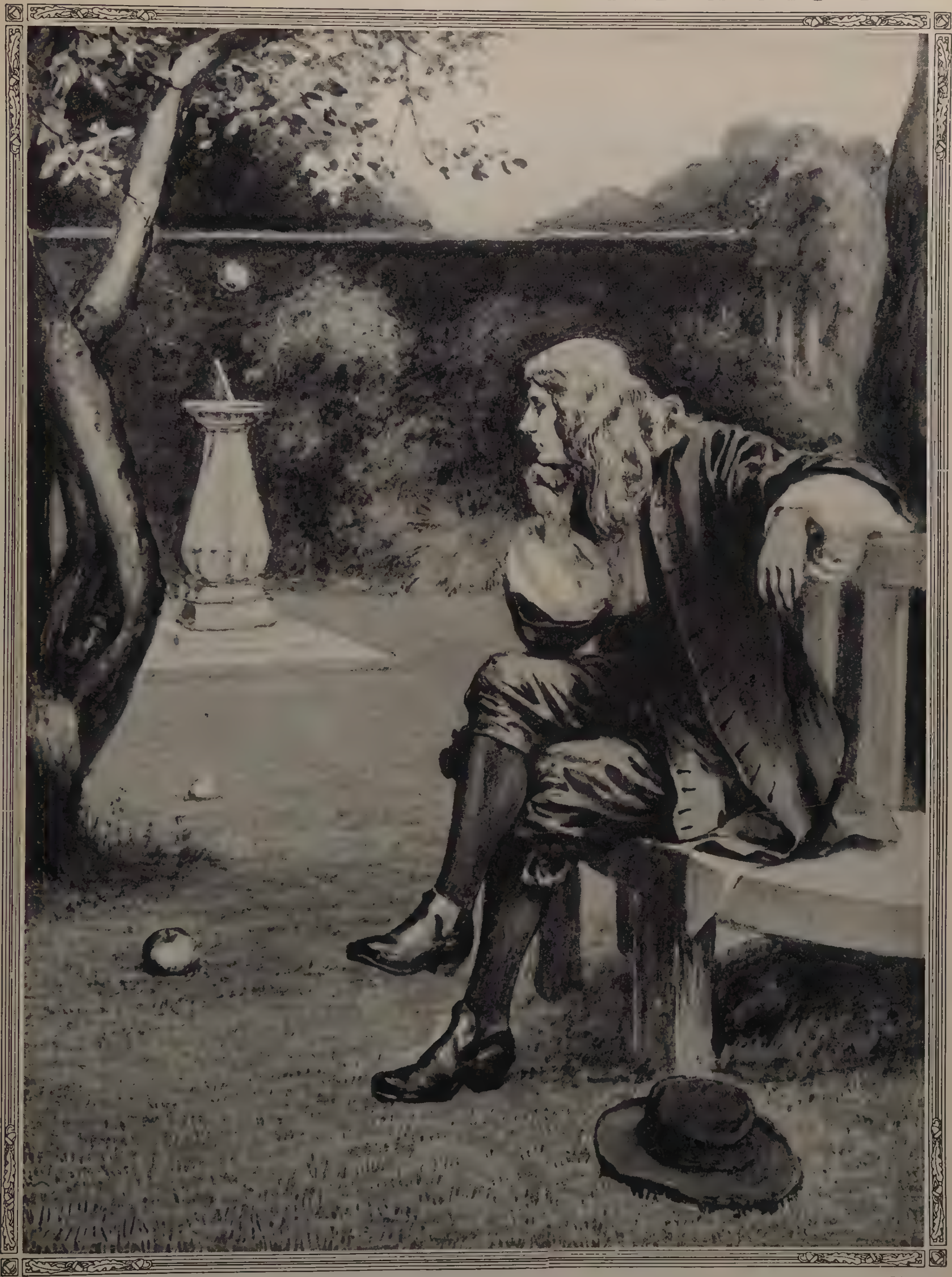
Story of the Mysterious Attraction that All Things Have for One Another—Why Bodies Fall Down and Not Up—"Weight" and What it Means—The Discoveries of Newton and Galileo

GRAVITATION. From the beginning of time a very remarkable thing has been happening, and few except very little children and very great philosophers have thought to ask why. That is, things have invariably been falling to the ground, and never in any other direction. Everything on the earth tends to fall, or to seek a lower position, unless held up by something beneath it. Even balloons and corks are not the exception that they seem to be. The force which causes bodies to act in this way we call "gravitation."

But is gravitation a mere local affair? What about other worlds than ours? More than 250 years ago a young man named Isaac Newton was walking in an English orchard wondering what the power is that keeps the moon forever swinging in its orbit around the earth, like a ball at the end of a string that a child keeps whirling around. Seeing an apple fall from a tree, he asked himself (so runs the story) if the same force which is so irresistible and so all-pervasive on earth might perhaps be the force that keeps the moon in its orbit by constantly pulling it toward the earth. Might not terrestrial gravitation be only one manifestation of a great universal Law of Gravitation, ruling not merely the fall of terrestrial things, but all motion in the universe—even the stately swing of the planets about the sun and of other stellar systems out to the uttermost bounds of space?

Now Isaac Newton was not the first man to whom such an idea had occurred. The great mathematician and astronomer Ptolemy of Alexandria had surmised something of the kind in the 2d century A.D.; and others since that time had had vague inklings of the existence of the great and splendid force divined by Newton. It's a long way, however, from vague surmises to sound scientific theory based on proof, but the materials for such proof had been gradually accumulating from Ptolemy's time to Newton's. He attempted to put his theory to the test of calculation, but his results did not agree with the moon's observed course, and he laid by the idea for years. At length more accurate figures were obtained for the distance of the moon from the earth, and when these figures were used the calculation of the action of gravitation on the moon was found to agree exactly with the moon's course, and similar calculations applied to the other heavenly bodies completed the chain of evidence. Gravitation was proved.

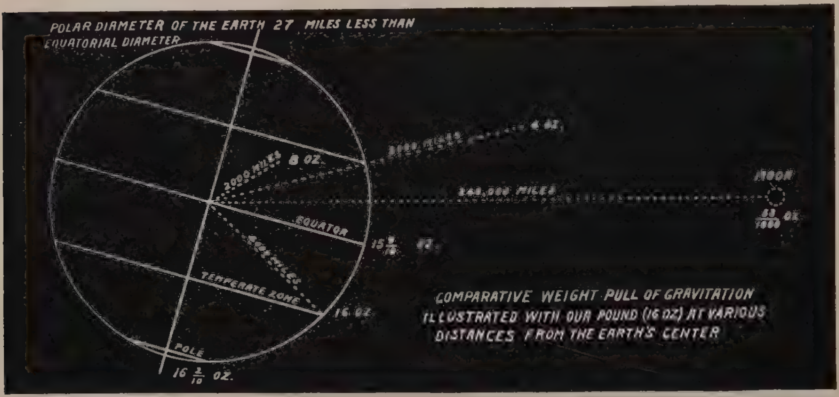
HOW A LITTLE APPLE STARTED A BIG IDEA



It was a great day — one of the greatest days in the whole of science — when Sir Isaac Newton, sitting in his garden at Lincolnshire, noticed an apple fall to the ground and asked himself, "Why?" The answer of a common mind would have been "Because it can't help it." But in the fertile brain of this great man the seed of a great thought was planted, and step by step he worked out the Law of Gravitation.

The great law of gravitation which Newton thus established is that *every mass of matter attracts every other mass of matter with a force which varies directly as the product of their masses and inversely as the square of the distances between them.* Observe, the attraction is mutual; if the earth attracts the grain of sand, the grain of sand attracts the earth. So the planets pull the sun while the sun pulls them. This relation of the pulling power of gravitation to mass implies some rather surprising things with regard to conditions on other planets, which may be found in the article on Planets.

HOW GRAVITY'S "PULL" AFFECTS WEIGHT


POLAR DIAMETER OF THE EARTH 27 MILES LESS THAN EQUATORIAL DIAMETER
4 OZ.
2000 MILES 8 OZ.
MOON
240,000 MILES
EQUATOR
TEMPERATE ZONE
16 OZ.
POLE
16 2/10 OZ.
COMPARATIVE WEIGHT PULL OF GRAVITATION ILLUSTRATED WITH OUR POUND (16 OZ) AT VARIOUS DISTANCES FROM THE EARTH'S CENTER

This diagram shows how the pull of gravity varies at different distances from the Earth's center. The unit of comparison is 16 ounces (one pound) weighed in the temperate zone. The general law is that the farther the object is from the center of the Earth, the less it weighs. Because the Earth bulges a little around the middle and is flattened at the ends, the pound will *lose* weight as you move it toward the Equator and *gain* weight as you move it toward the Poles. If the pound were taken to the Moon, the Earth's pull upon it would be only a fraction of an ounce. At a depth of 2,000 miles in the Earth, the pound would weigh only eight ounces. This seems to violate the law about "the nearer the center, the greater the pull." But remember that now the 2,000 miles of earth *above* our pound weight would be tending to pull it *upward*, thus counteracting a part of the *downward* pull.

The most important step in the study of gravitation on the earth, before Newton formulated his law of its universal action, had been taken about a century earlier. For nearly 2,000 years men had been repeating the dictum of the great Aristotle that heavy objects fall more swiftly than light ones, and that the rate of speed is in proportion to the weight of the object. Not until the end of the 16th century was anyone so impertinent as to try to find out whether Aristotle could have been mistaken. Then an inquisitive young man named Galileo climbed the Leaning Tower of Pisa and dropped from the top two objects of different weights. They struck the ground at the same time! And great was the scandal thus created among the wiseacres, who wanted to know what the world was coming to, if a mere nobody were to be allowed to dispute the word of the infallible Aristotle!

But Galileo must needs experiment further, and find out that falling bodies constantly acquire more speed the farther they fall. An apple falling from the limb of a tree 16 feet above the ground strikes the ground in one second, and one dropped from a tower window 64 feet high strikes the ground in two seconds. In other words, a falling body drops 16 feet in the first second, 48 in the next, and 80 in the third—or 144 feet in the first three seconds. Every second that a body falls, it gains 32 feet over the speed it had the second before. Otherwise stated, the Law of Falling Bodies is that the distances traversed by any falling body from the beginning of its fall to any two or more points during the fall are to each other as the squares of the times in falling.

That is why you can fall from a chair to the floor without hurting yourself much, while, if you were to fall from the roof or upper window of a high building, you might break most of your bones, even if you were lucky enough not to be killed. When you strike the floor in falling from the chair, you are still moving comparatively slowly, while by the time you strike the ground in falling from the roof, you are moving with terrific speed. This is also why it is so much more dangerous to be struck by a brick or a stone dropped from a great height than by one which has fallen only a short distance.

The strength of the earth's pull on each object is the weight of that object, and since the strength of the pull diminishes as the distance increases, the weight of the same object varies at different points on the earth's surface. If you were to weigh five pounds of lead—or wood or cotton or anything—carefully on a spring balance at one of the poles, and then take it to the Equator and weigh it again on the same scales, you would see it stretch the spring a very little bit less, because it is farther away from the center of the earth. Likewise, you would find that the same object weighs less on a high mountain top than at sea-level, the difference being about 1/2,000 of the weight for every two miles of elevation.

Furthermore, the weight of an object is in proportion to its mass, that is, the amount of matter it contains. Two lead balls of the same size would not weigh the same, of course, if one were solid and the other hollow. A block of wood weighs less than a block of lead of the same size for a similar reason, namely, that the particles of matter in the wood are not so closely packed as the particles of matter in the lead. In other words, lead is denser than wood, and wood is denser than cork or cotton batting.

It is important to have a measure of density—of the closeness with which matter is packed—to know in short the "specific density" of different substances. It was Archimedes who first put us in the way to find this (*see* Archimedes). Having noticed no doubt that any object suspended in water seems lighter than in air, Archimedes tried weighing various substances in air and water. Thus he discovered one of the most important principles of hydrostatics. This, the "principle of Archimedes," is that a body wholly immersed in any fluid is buoyed up by a force equal to the weight of the fluid it displaces.

If a substance is weighed first in air, then in water, and the weight in air is divided by the loss of weight in water, the result, which expresses the density of that substance as compared with water, is called the "specific gravity" of that substance. The specific gravity of gold is 19.3; that of silver, 10.5. That is, gold is 19.3 times as heavy as water, silver only 10.5 times. So, if Archimedes found the specific gravity of the king's crown to be less than 19.3, he was confirmed in his conclusion that the goldsmith had not made it of pure gold alone.

Another important division of this subject has to do with the "center of gravity" of solids. The center of gravity of any object is the center of its mass or weight. In a symmetrically shaped object of the same density throughout, the center of gravity will be at the geometrical center. If the center of gravity is "supported"—if a line dropped from the center of gravity passes through the base of the object—that object is in equilibrium and will not fall. This is the case with the Leaning Tower of Pisa, from which Galileo made his experiments. The tower stands safely, but if you want to know what would happen if it were to be built higher, try building a leaning tower of blocks. It stands so long as the center of gravity is over the base; but when the center of gravity is carried up so that it is no longer above the base, over goes your tower.

The tight-rope performer has learned by long experience to keep the center of gravity of his body directly over his base of support, the wire. Of course the narrower the base the more difficult it is to keep the center of gravity exactly over it. This is why it is hard to balance a pencil or an umbrella, and also why tight-rope walking is difficult and dangerous. It is easier for a baby to creep than to walk, because when he is on all fours his center of gravity is carried over a broader base than when he stands on his feet.

GALILEO'S EPOCHAL EXPERIMENT

Will a heavy object fall faster than a light one? There are still probably a good many people who would answer confidently, "Of course a heavy object will fall faster." That's what the world thought until Galileo went up in the Leaning Tower at Pisa, Italy, and made his famous experiments. He chose this tower, not only because it was high, but because he could drop things off without hitting the sides of the building on the way down. Here we see him just about to let fall two iron balls, one much bigger than the other. They both hit the ground at *exactly the same time.*

From the beginning of life to the end we are playing a game with the force of gravity. The baby trying to carry a spoonful of bread and milk to his mouth without spilling it, or to balance himself on his two little legs, is just learning to play the game. So are the architect and the engineer, each using all his knowledge of mathematics and physics in the construction of buildings, bridges, and railroads. So most emphatically is the aviator, whether he flies safely and sanely or performs daredevil "stunts." A curious game it is, with the force of gravity as both opponent and partner.

What has been explained here is but the beginning of a glimpse into the known facts of this great law; and don't imagine that everything about it is known even yet. From one point of view it seems very simple—the most sweeping and unconditional generalization yet made in regard to the workings of the universe. But neither has Newton nor anyone else yet shown the nature of the force which operates through the law of gravitation. *How* the apple falls to the ground we know—it is in accordance with an unvarying universal law; but we don't yet know *why* the apple falls.

GREAT BRITAIN. A strip of water only 21 miles wide separates the French city of Calais from the "tight little island" of Great Britain. But the rough waters of the English Channel, the North Sea, Irish Sea, and St. George's Channel, which surround it, shut the people of Great Britain away from their enemies in the days of their weakness, and when they grew strong the sea furnished them broad highways by which they might trade with other nations. The people of Great Britain have put their trust in its waters, and their merchant marine and navy have made their land the "mistress of the seas."

This little island—about the size of Minnesota—which stands at the western door of Europe, has been favored by nature in many ways. It has an excellent climate, neither very cold in winter nor very hot in summer, and with an abundance of rainfall. Its broad deep rivers—the Thames, Humber, Severn, Mersey, and Clyde—admit ships a considerable distance into the land. On its fertile soil can be grown most crops of the temperate zone. And in its mountainous regions of the north and west are to be found unsurpassed deposits of coal and much iron, without which Great Britain could never be the industrial nation it is today. In her 88,210 square miles there is almost every kind of land, from the lowlands of southeastern England to the rugged highlands of Scotland and Wales.

Before 1707 Great Britain was merely a geographical name. The chief country in the island was England, to which Wales had been added by conquest in 1282; and to the north was the separate kingdom of Scotland. Since James VI of Scotland had ascended the English throne in 1603 as James I of England, the two countries had always had the same ruler. But it has only been since the Act of Union of 1707 that the two countries have been united under the name of Great Britain. In 1801 another Act of Union brought Ireland, which had long been a dependency of England, under the same Parliament with Great Britain, and the official name of the country was changed to the "United Kingdom of Great Britain and Ireland." In this same government are included also the other British Isles—the Hebrides, Orkneys, Shetlands, the Isle of Wight, and the Isle of Man—and the Channel Islands (Jersey, Guernsey, Alderney, and Sark).

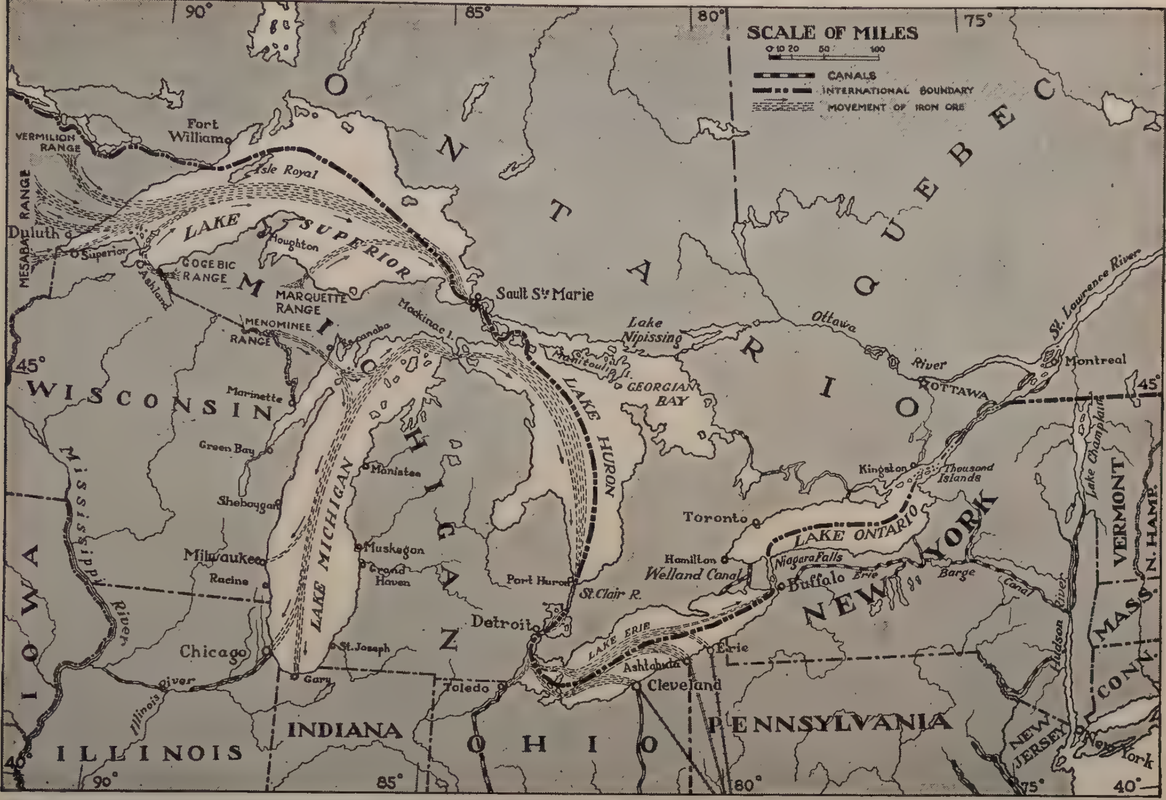
The union of Scotland, Ireland, and England is shown by the flag of Great Britain. Before the first Act of Union the flag of England was white, with a large upright red cross; that of Scotland was blue, with a diagonal white cross; and a red diagonal cross was one of the emblems of Ireland. In the modern "Union Jack," all three of the crosses are united in a single emblem. (*See also* British Empire; England; Ireland; Scotland; Wales.)

NORTH AMERICA'S GREAT UNSALTED SEAS

ITALY and Spain and Greece have their Mediterranean, the most romantic of inland seas. But the United States and Canada have their own Mediterranean—the Great Lakes, whose sparkling waters and blue skies and great cities present scenes rivaling those of the Old World Mediterranean for charm and beauty. Two centuries ago their waters were furrowed only by the occasional canoe of the Indian or the fur-trader; today they float a merchant marine of thousands of huge freighters, carrying a commerce richer than that of many a powerful nation.

GREAT LAKES. In all the world there is no other system of inland waterways that compares with the large lakes—Superior, Michigan, Huron, Erie, and Ontario—that lie along the boundary between the United States and Canada. These inland seas are nearly as large as all the other fresh-water lakes of the globe put together, nearly 100,000 square miles, and the thousand or more streams that feed them drain an area of about 288,000,000 square miles. To coast along their shores in the United States alone you would travel more than 4,000 miles. So vast are they that their storms are like ocean storms, and they have an oceanic effect upon the climate, absorbing heat in summer and giving it out in winter, thus tempering the extremes of climate along their shores. As a result, parts of Michigan, and the southeast shores of Lakes Erie and Ontario, where the effect of the lakes is most felt because of the prevailing winds, are important fruit districts.

THE TRAIL OF COMMERCE ON AMERICA'S INLAND SEAS



Here are the five lakes which are among the busiest bodies of water in the world. The heavy broken line shows how the boundary between the United States and Canada divides them. The light lines show the lanes followed by the iron ore traffic. The ore is dug in the great ranges of Minnesota, upper Michigan, and Wisconsin, and is carried by rail to ports on Lakes Superior and Michigan. From these ports it is transferred by boat to the mills on or near Lake Michigan and Erie. This traffic alone maintains a string of steamers scarcely out of sight of each other's smoke all along these lanes, and when you remember that iron ore is only one of many commodities carried on the Lakes, you can understand how important they are in America's economic life. Note the canal routes connecting the Lakes with the important rivers to the south and east.

Varying in depth from 1,000 feet in Lake Superior to 210 feet in Lake Erie, the lakes are open to navigation by large vessels from end to end. You may take a steamer the size of an ocean liner at Buffalo and sail away for a thousand miles to Duluth or Chicago, nearly half the length of the Mediterranean. On smaller craft you may voyage farther still. Barges and pleasure launches go down the Chicago drainage canal to the Illinois River, the Mississippi, and the Gulf of Mexico; while vessels of 14-feet draught can pass around Niagara Falls by the Welland Canal, and down Lake Ontario and the St. Lawrence River to the Gulf of St. Lawrence and the ocean. Projects have long been on foot to deepen both these "lakes to ocean" routes, so that ocean steamers of 30-feet draught may ply between lake ports and foreign cities, thus saving the expense of trans-shipping cargoes from lake to ocean vessels.

DIMENSIONS OF THE GREAT LAKES

Lake Superior.—Length, 400 miles; greatest width, 167 miles; area, 31,200 square miles; greatest depth, 1,008 feet.

Lake Huron.—Length, 250 miles; average width, 150 miles; area, with Georgian Bay, 23,200 square miles; greatest depth, 702 feet.

Lake Michigan.—Length, 316 miles; average width, 75 miles; area, 22,400 square miles; greatest depth, 868 feet.

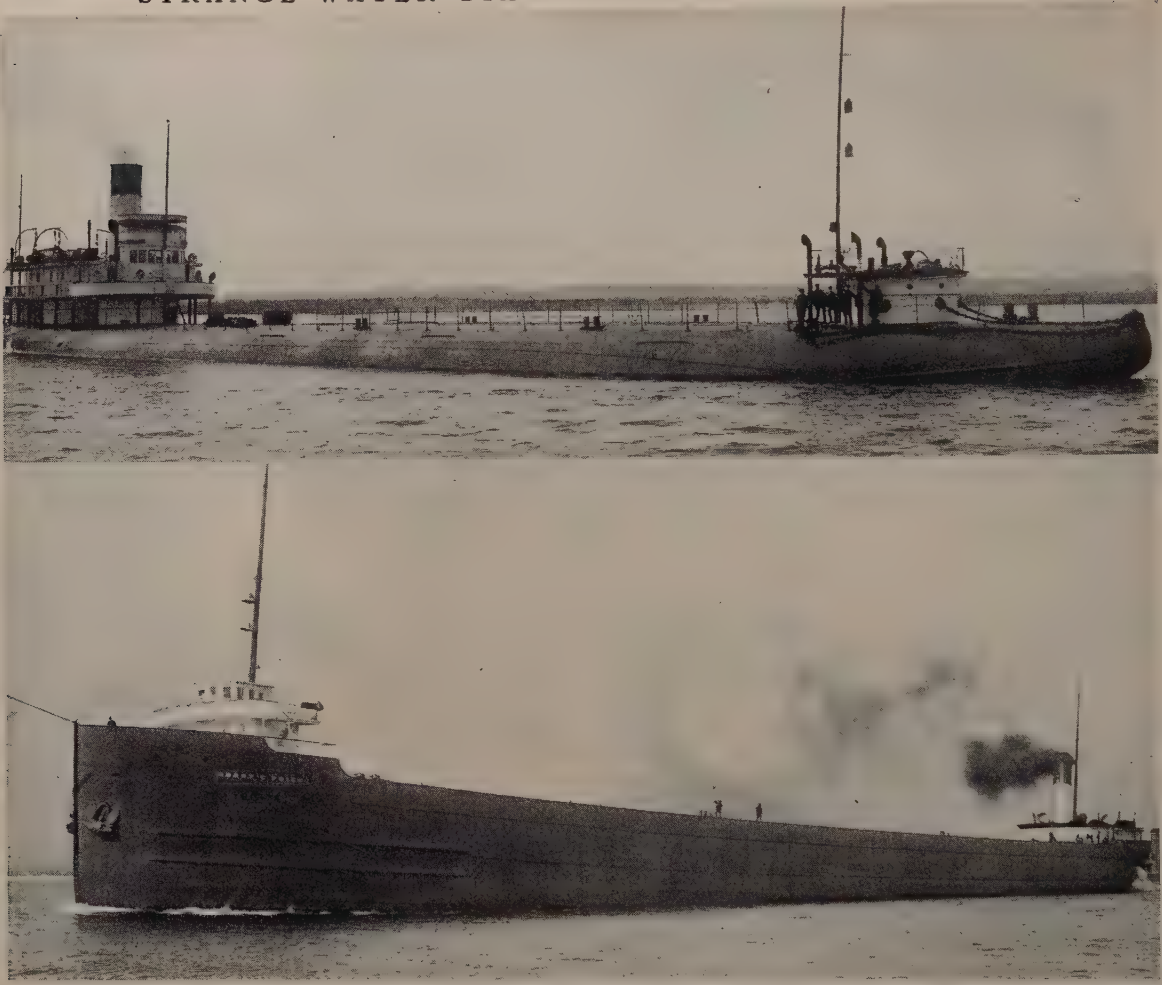
Lake Erie.—Length, 245 miles; greatest width, 57 miles; area, 10,000 square miles; greatest depth, 210 feet.

Lake Ontario.—Length, 190 miles; greatest width, 53 miles; area, 7,260 square miles; greatest depth, 738 feet.

From December or January until April the lakes are in large part ice-bound, and vessels lie idle in the river harbors of Chicago, Cleveland, Buffalo, and other ports. Terrific storms mark the end of the navigation season, and the freighter that ventures out for one last trip is sometimes never heard from again, or perhaps hobbles into port coated with ice, and with hundreds of its rivets shaken out by the buffeting of giant waves. Whitefish Bay, at the east end of Lake Superior, is known as "the Graveyard of Ships," from the many wrecks there.

The importance of these great waterways to the prosperity of the United States and Canada cannot be overestimated. The vast region tributary to them is the richest part of the continent in farm, forest, and mine products. Without the cheap transportation which the lakes afford, the development of the Northwest would have been far slower. If you have

STRANGE WATER GIANTS OF THE GREAT LAKES



The peculiarly violent choppy storms that sweep over the Great Lakes make special types of freight vessels desirable. At the top we see the famous old "whale-back" type, with a hull shaped like a submarine. This allows the waves to break freely over the ship, while the ship yields and rolls, and so avoids the strain upon its framework. The lower vessel, however, has proved even more efficient than the "whale-back." The entire middle of the ship is one great open cargo space, and the main ribs of the hull all run lengthwise, so that the craft can twist and give under the buffeting of the waves.

never visited Chicago, Detroit, Duluth, or Buffalo, you would find it hard to realize the immensity of the Great Lakes commerce. More vessels enter and clear at Chicago than at any other port of the United States, excepting only New York. A greater tonnage passes through the Detroit River in the seven or eight months of navigation than that which enters and clears at all the Atlantic and Pacific ports in a year, and almost as much passes through the "Soo." About four-fifths of all the iron ore used in the United States is transported by water from the Lake Superior region, and without this advantage the immense iron and steel industry of the United States could never have prospered as it has done.

The fisheries too are an important resource, for they are the greatest lake fisheries in the world. The United States waters alone produce more than 100,000,000 pounds of food fish every year—whitefish, lake herring (cisco), lake trout, pike, and perch. Lake Michigan and Lake Erie contribute about three-fourths of the entire catch.

From Chicago you may take almost as many different lake voyages as there are days in the summer passenger season. You may make a day's trip across to one of the summer resorts on the east shore of Lake Michigan—Benton Harbor, Holland, Muskegon, South Haven, Ottawa Beach, or St. Joseph—whose gently sloping sandy beaches are a delightful place to swim; or you may spend several days coasting the western shore of the lake, stopping at Racine, Milwaukee, Sheboygan, and the Green Bay ports. At the head of the lake you will come to Mackinac Island, lying in the Straits of Mackinac, between lakes Michigan and Huron. This popular summer resort, with its clear air and delightful pine woods, its old fort built by the French in 1712, and its French

ALONG THE SANDY SHORES OF LAKE MICHIGAN

Nothing could be more typical of shore scenery along the Great Lakes than this wooded sandy bluff. Sometimes with a smooth sandy beach in front and sometimes dropping off sheer into the water, this type of shoreline runs around much of Lake Michigan. The railroad train is carrying "week-enders" southward from the summer resorts in northern Michigan on an over-night run to their work in Chicago.

and Indian traditions from fur-trading days, was at one time one of the important military posts of North America.

From Mackinac, if you are bound for Lake Superior, your steamer will go eastward for 60 miles to St. Mary's River, wind for another 50 miles through its narrow channels, and then climb the great steps of either the Canadian or American locks at Sault Ste. Marie to the highest as well as the largest of the Great Lakes. There has been a canal with locks on the American side of the "Soo" since 1855, to pass around the rushing rapids (*sault*) where the St. Mary's River issues from Lake Superior. Today there are two great series of locks. One of the locks in the American canal (completed in 1919) is 350 feet longer than the locks of the Panama Canal; and the Canadian locks also are huge (*see* Sault Sainte Marie).

Here you will see such a scene of activity as few of the world's great waterways can show. Great barges and passenger steamers with their prows and sterns a city block apart go through at the rate of one every 12 minutes. Many of the west-bound barges carry coal from Ohio and Pennsylvania for the northwest; while most of those east-bound are heavily loaded with immense cargoes—10,000 to 12,000 tons—of copper ores from the "copper country," or of iron ores from the upper peninsula of Michigan and the ranges about Duluth. Others carry hundreds of thousands of bushels of wheat grown on the farms of the American or Canadian Northwest, a single boat sometimes bearing under its hatches the grain from 30,000 acres. Now and then you see a boat loaded from stem to stern with lumber, which not only fills its hold but is piled high on its decks. Nearly a thousand vessels are engaged in the "coal for iron ore" exchange alone, and some seasons over 100 million tons of freight go through the Sault Ste. Marie canals, while the shipping tonnage totals three times as much as goes through the Suez Canal in normal years.

When your steamer has climbed the locks at Sault Ste. Marie, there is still a 30 hours' journey before you on Lake Superior. A hundred miles farther on, if the weather is good, your ship will go near shore so that you may see the Pictured Rocks. This ten miles of cliff, banded with blotches of red and yellow and carved into pillars and caverns, shows where the lake level used to be a few thousand years ago. The next day the ship stops at Houghton and Hancock on the Keweenaw Peninsula, where one-seventh of the world's supply of copper is mined every year, and from which freighters have been known to carry a cargo worth a million and a quarter dollars. Instead of rounding the peninsula the ship goes through a canal between the twin cities, and in another half-day lands you at Duluth (Minn.), the western head of lake navigation. Ten miles south lies Superior (Wis.), a rival to Duluth for the lake traffic. At all these ports you will again meet the freighters unloading coal in enormous piles a block or two long, and then taking on cargoes of iron ore at giant piers which stretch far out into the harbor and tower into the air like grain elevators. Through a score or more of chutes the ore pours into the opened hatches with such speed that a ship can take on a 12,000-ton cargo in two hours. About 150 miles northeast of Duluth you would find grain being loaded in enormous quantities at the Canadian ports of Fort William and Port Arthur.

But perhaps you turned eastward at Mackinac Island or the "Soo" instead of westward. A small steamer will take you by the picturesque route back of Grand Manitoulin Island past Little Current and Kilarney to Parry Sound, on Georgian Bay; whence a still smaller steamer will carry you in and out among the amazing variety of the Thirty Thousand Islands

THOUSANDS SEEK THE BEACHES IN SUMMER

Here is the beach at Macatawa Park, one of the many summer resorts which dot the eastern shore of Lake Michigan. Practically all of these resorts are of the same general pattern. A placid river comes wandering westward from the interior of Michigan and upon encountering the shoreline bluffs broadens out into a small lake. A narrow channel, improved by jetties such as you see in the background, connects the inland lake with the larger body of water. Thus these resorts combine the attractions of a small lake with its boating, the large lake with its surf and cool breezes, the wooded hills of the shoreline, and the open farming country inland.

which dot the bay and form a paradise for fishermen and summer cottagers. Or you may have continued from Mackinac on to Buffalo. For 250 miles you travel over Lake Huron to Port Huron, at the entrance to the St. Clair River. For 30 miles you steam between the banks of rich and beautiful country, tapering off into "the St. Clair flats," where lies a summer settlement sometimes called "Little Venice," for under the *portes cochères* of the houses you will find water instead of driveways. A canal a mile long then brings you out into Lake St. Clair, and 18 miles farther finds you at Detroit. Another 20 miles along the beautiful Detroit River and you are on Lake Erie, 8 feet lower than you were on Lake Huron, although you have not had to climb down any locks to overcome this difference in level. A few hours more, and you reach Buffalo, where you see vast cargoes of grain unloaded from big lake barges and transferred to canal boats or freight cars for shipment to the large eastern cities.

Steamers of 14-feet draught may go farther still—through the Welland Canal around Niagara Falls, and so on down Lake Ontario and the St. Lawrence River to the Gulf. This is the way many lake freighters were taken out to the ocean during the World War of 1914–18, though the locks of the old Welland Canal were so small that some of the ships had to be sawed in two to make the trip.

The history of the Great Lakes dates back nearly 300 years. The French discovered Lake Ontario in 1611, and four years later Champlain discovered Lake Huron, following the famous Algonquin route up the Ottawa River, portaging across to Lake Nipissing, and thence down the French River to Georgian Bay. Lake Erie was the last (1669) to be reached by white men, owing to the hostility of the Iroquois tribes. The first sailing vessel on the lakes was La Salle's *Le Griffon*, of 40 or 50 tons, launched on the Niagara River in 1679. The first steamboat appeared on Lake Ontario in 1817. The opening of the Erie Canal in 1825 started immigration westward by canal and lake, and by 1833 there were 11 steamboats on the lakes making a trip or two each season from Buffalo to Chicago. Today the great passenger steamers are the safest and most comfortable means of travel during the navigation season between many points on the lakes. Government charts of the lakes showing lighthouses, lightships, buoys, and life-saving stations now facilitate navigation, which calls for as high a degree of skill as navigation upon the high seas, although it presents somewhat different problems.

In order to give big steamers an opportunity to load as deeply as possible, commissions of American and Canadian engineers keep constant watch over the water levels in each of the lakes. This is necessary because the channel at Niagara and the Drainage Canal at Chicago draw off enormous quantities of water, and if the level of the lakes should be lowered by even a foot below the standard depth, the heavily loaded cargo steamers could not get over critical points in various channels with safety.

Several important naval engagements were fought on the Great Lakes during the War of 1812, notably the Battle of Lake Erie (*see* Perry, Oliver Hazard). Then in 1817, at the instance of John Quincy Adams, then Secretary of State of the United States, the Great Lakes were neutralized by agreement between Great Britain and the United States. For more than a century no naval force has been maintained on their waters, and the forts which had been erected to protect strategic points have been left to molder into picturesque ruins. (*See* Canals; *also* articles on the various lakes.)

GREAT SALT LAKE. There should be no more popular resort for bathers than Great Salt Lake, the mysterious mitten-shaped sheet of water in the midst of Utah's desert plain. It is impossible for anyone to drown in it unless he deliberately puts his head under the water or ties a weight to his feet, because the water is one of the most concentrated brines in the world. The bather may sit in it, or float upon his back with his arms crossed under his head and enjoy a pipe with as much comfort as on the shore. But he must wash the water off after he bathes or he will be encrusted in salt.

This "Dead Sea of the New World" bears a striking resemblance to the famous one in Palestine. It has a Jordan River, too, but although the lake has been receiving its waters for centuries, there is no visible outlet. Because of its extreme saltiness it contains almost no plant or animal life, and although very shallow, is really a sea in its dimensions, having about 1,700 square miles. Its area, however, is variable, because during some periods it receives more water than it loses by evaporation. It is only a remnant of a far greater lake, called by geologists Lake Bonneville, which ages past covered an area of nearly 10,000 square miles with a depth of 1,100 feet.

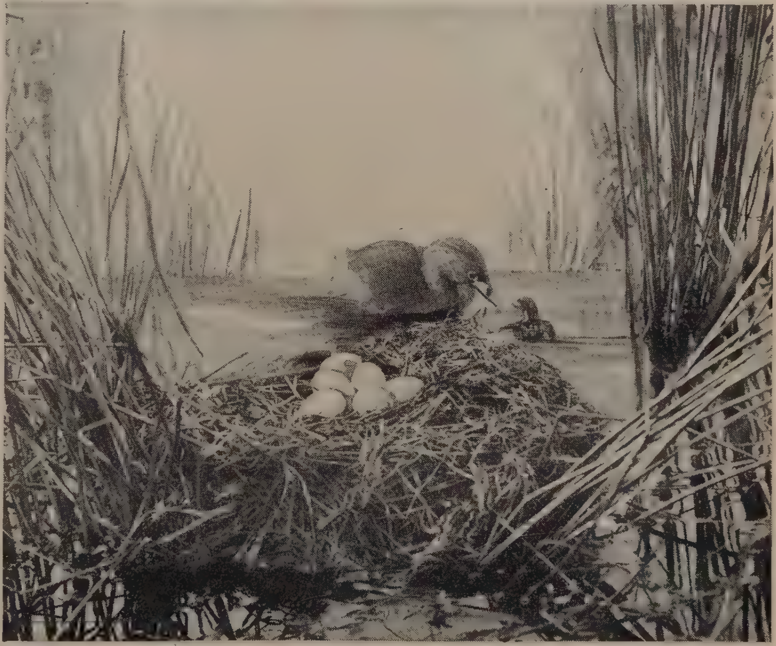
One of the most noteworthy engineering achievements ever attempted in trestle and fill-in work is the cut-off through the north arm of the lake, between Ogden and Lucin. This shortening railroad was built at enormous cost to avoid the steep grades encountered in the old line around the north shore of the lake.

The Mormons early utilized the salt of the lake, and the salt works and refineries on its shores obtain crude salt simply by pumping out the water and evaporating it in shallow beds on the shore. Geologists place the total of the available salt deposits at 400,000,000 tons.

GREBES (*ḡrēbz*). The young grebe is a true "water baby." When he has pecked his way out of the egg, he finds himself on a sort of raft-nest floating on the water. For a few minutes he looks over the edge of the raft, observers tell us, and then—splash! Over he goes, swimming off with all the skill of an old hand. But young birds are too weak for much violent exercise, so the grebe parents have a most interesting way of taking the little ones riding on their backs. Sometimes you can see an old grebe with two or three chicks nestling just under the wing-coverts, with only their heads exposed. At the slightest sound, up go the parent's feathers, completely hiding the chicks, and sometimes if alarmed the old birds will dive, keeping the little brood in place under the wings.

On land, the grebes are comical sights. Their legs are placed so far back that when they walk they carry their bodies upright, like penguins, waddling along with great awkwardness. Sometimes they wriggle along on their bellies, like seals. Their feet are not webbed in the same way as those of most diving birds, but have a separate membrane for each toe, united only at the base. Their shanks are flattened to bladelike thinness, and when they fly on their short powerful wings the feet trail behind like a rudder. But the water is their native element, rather than the air, and they swim and dive with wonderful skill, being able to swim long distances under water. Their smooth hairlike plumage is quite waterproof, and the beautiful silver-white breast feathers are so much coveted for millinery and for muffs and dress trimmings that thousands of these interesting birds are slaughtered every year.

MOTHER GREBE AND HER WATER BABY



The little Grebe has just been hatched out of his egg in the floating nest and has promptly tumbled into the water for a swim. Mother Grebe is probably teaching him a few strokes. By and by those other eggs will hatch and the mother will take them all riding on her back.

There are about 25 species of grebes, spread over most of the world. They form the family *Colymbidae* of the order of diving birds (*Pygopodes*), which also includes the loons, auks, and puffins. The best known of the American grebes is the pied-billed grebe (*Podilymbus podiceps*), also known as the hell-diver, the water-witch, or the American dabchick. It is about 13 inches long, with a short thick bill; plumage brownish-black above and light brown and white beneath. (For illustration in colors, *see* Birds).

A GOLDEN DAY IN GOLDEN GREECE

This Greek mother and her children are walking in the streets of ancient Athens. In the background are the famous buildings of the Acropolis bathed in sunshine. The distinguished French artist André Castaigne has here successfully caught the spirit of those glorious days of old, when life was more serene and leisurely than it is in these busy modern times. Beauty to the Greeks of old was one of the most important things in life, and no other people has ever realized the ideal of beauty so completely in their everyday surroundings.

The LAND where EUROPEAN CIVILIZATION was BORN

These ruined walls and columns on the Acropolis at Athens, scarred by the ravages of the centuries, mark the center of what was once the Intellectual Empire of the World. Such fragments of the architecture of the Greeks, the immortal forms they carved from the marble of their mountains, their superb achievements in literature, and the noble system of government they created, have been among the most vital sources and inspirations of the Architecture, the Art, the Literature, and the Free Institutions we enjoy today.

Extent.—North to south, about 365 miles; west to east, about 350 miles. Area, about 45,000 square miles, of which the peninsula of Greece (roughly corresponding to the ancient Hellas) occupies about 25,000 square miles. Population, about 5,000,000.

Physical Features.—Deeply indented mainland coast, with many small islands, especially Cyclades and Sporades groups in Aegean Sea. Corinthian and Saronic gulfs nearly separate northern and central Greece from southern Greece (Peloponnesus or Morea). Four-fifths of the surface covered by complicated mountain systems, inclosing many small valleys; chief ranges, Cambunian and Pindus; highest point (in Thessaly), Mount Olympus (9,754 feet). No navigable rivers.

Products.—Wheat, barley, rye, and other cereals; currants, grapes, and wine; olives and olive oil, figs, oranges, lemons, etc.; tobacco, silk; sheep and goats; iron ores, lead, zinc, lignite; textile and leather manufactures.

Chief Cities.—Athens (capital) and its port Piraeus (combined population, more than 425,000), Saloniki (250,000), Patras (40,000).

GREECE. The traveler in Greece often finds himself wondering how so small a country could fill so large a place in history. Even including the territories won as a result of the Balkan War of 1913 and the World War, it is smaller than any one of 20 states of the American Union. From Mount Olympus, which marked the northern limit of ancient Greece, you can see over nearly all northern and central Greece; and if you take your stand on Mount Parnassus (modern Liakoura), which is near the center of Greece, you can see nearly all the mainland spread out below you like a map. Travel less than a hundred miles south, and from the mountains of Sparta you can see Crete, the southernmost of the 500 islands which make up an important part of Greece.

But though this little country is only a small patch on the map of the world, it was the cradle of European civilization and has wielded a greater influence on the course of history than any other single nation. Why? The answer is largely a matter of geography. It was their land and sea, their mountains, bays, and islands, that helped to make the ancient Greeks what they were and determined the course of their history.

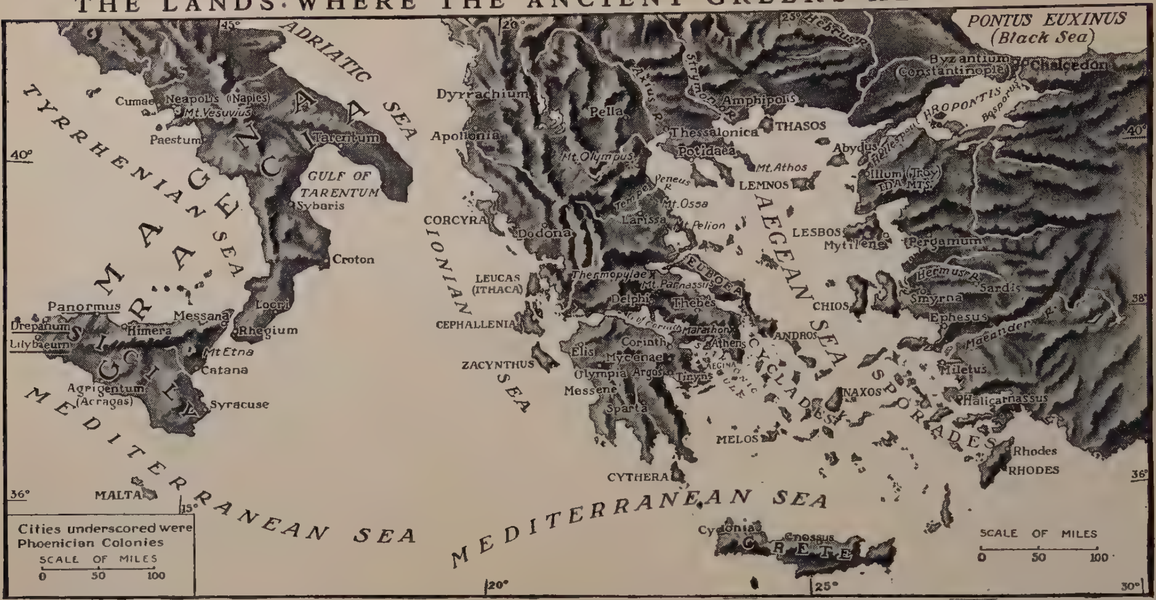
First you must notice that Greece is the easternmost of the three peninsulas that Europe throws off into the Mediterranean toward Africa and Asia, where man first emerged from barbarism to civilization. Between the mainland of Greece and the coast of Asia Minor the sea is thick-strewn with hundreds of islands—the tops of submerged mountains that once formed a continuous land-bridge. These islands are like a series of stepping stones, inviting to travel, and so the inhabitants of Greece were the first of European peoples to be brought into contact with the civilizations of Asia (*see* Aegean Civilization).

Look more closely at the map, and you will observe that the sea fairly riddles the land, forming so many gulfs and capes that no part of Greece outside Thessaly in the north is more than 50 miles from the coast. So many are the indentations that the coast-line of the Greek peninsula is longer than that of Spain and Portugal, although those countries are six times its size. The greatest of these inlets is the Gulf of Corinth, which all but cleaves Greece in two. The only connection is the narrow Isthmus of Corinth (which is now cut by a canal), so that southern Greece, or Morea as it is now called, was known to the ancient Greeks as Peloponnesus (Pelop's Island).

Thus the sea everywhere opened its beckoning arms to the Greeks and invited them to the adventurous and progressive life of the mariner and trader. Their natural keenness and alertness was intensified by this constant intercourse with other peoples, their imagination and thought were stirred, forming fruitful soil in which the seeds of Egyptian and Asiatic civilization might bear new and finer flower.

This urge to the sea was reinforced by the character of the Greek land itself. Four-fifths of its surface is wrinkled by a complex system of mountain ranges which chop the surface up into a number of tiny plains. Practically all the arable land is contained in these little isolated valley-patches. One-third of all

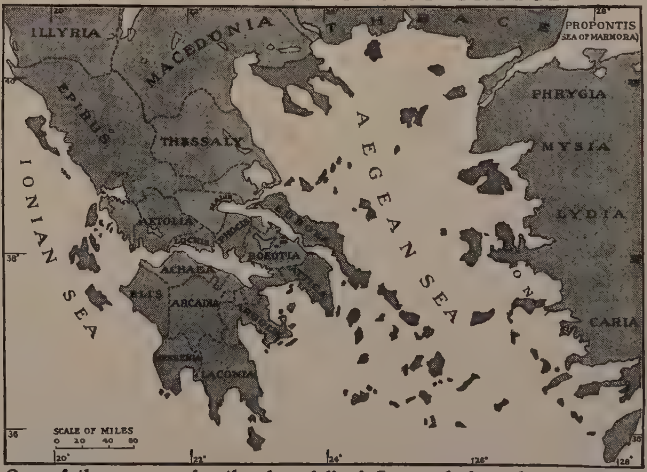
THE LANDS WHERE THE ANCIENT GREEKS HELD SWAY



We must remember that in olden days the name "Greece" did not mean the Greek peninsula alone. It included also the "sprinkled isles" of the Aegean Sea, the western slopes of Asia Minor, Crete, Sicily, and southern Italy. Indeed, the last two were known as "Magna Graecia" (Greater Greece). In all these outlying lands were Greek colonies—mostly of the city-state type, patterned after Athens, Sparta, Thebes, and the other cities of the homeland. Although they were for the most part independent communities, often at war with one another, they were spiritually united by the great bond of Greek civilization and culture.

the surface today is waste land—rock and sand and gravel—with no soil that will grow even grasses. The remainder is divided between the forests, from which the Greeks obtained the charcoal that formed their only fuel, and the pasture land, most of it bristling with prickly asphodel and other dry scrub, too juiceless for the taste of any animals but sheep and goats. A few cows and pigs were raised, but sheep and goats supplied most of the meat that the Greeks ate, as well as wool and cheese. The "harvests of the sea" —chiefly tunny, sardines, and anchovies —largely took the place of meat in the Greek diet. On the scanty areas of tillable land were grown the "Mediterranean triad"—grains, wine-grapes, and the olive—which formed their staple foods. Moreover these lands were far from being remarkable for fertility, and much hard labor was necessary to grow wheat and barley successfully. The few rivers are small and rapid; none are navigable and many are dry in summer. Thus, unlike the Italians, with their fertile soil, the Greeks were fairly pushed off the land to make good its deficiencies by trade and by settling the surrounding islands and coasts. Their constant struggle with a niggardly land also tended to make the Greeks a vigorous and energetic people. Greece was, as Homer puts it, "rough, but a mother of men." This is no less true of the bracing winter climate. The summers are clear and almost rainless; the winters sharp with heavy rains and snows. No barriers intervene to break the force of the winds which sweep across from the Asiatic continent, and this helped make the Greeks a tough and hardy race.

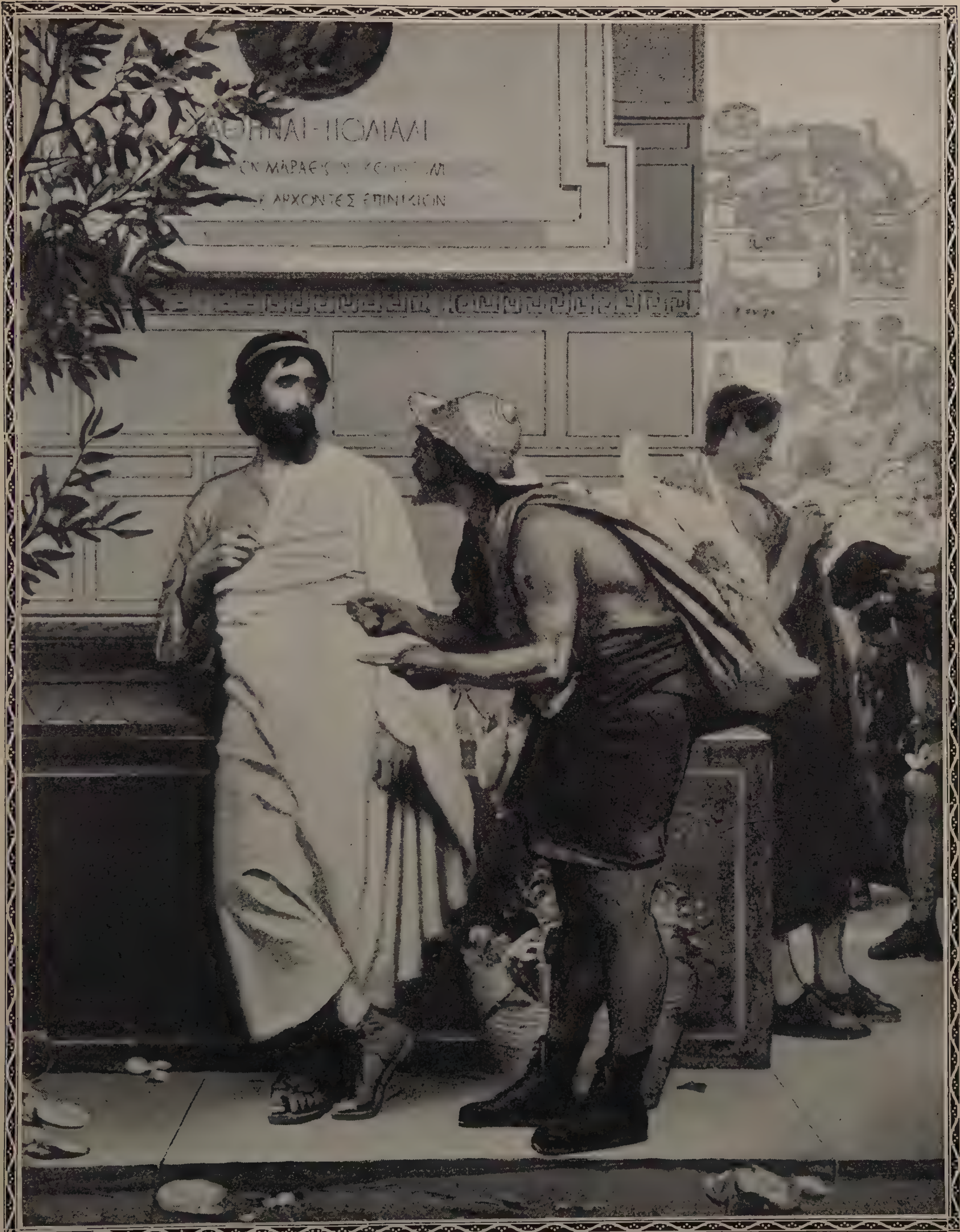
THE DIVIDED STATES OF GREECE



One of the reasons for the downfall of Greece before the conquering sword of Rome was the lack of political unity between the many small states into which the peninsula was divided. These political divisions were caused by the numerous inlets from the sea and the many mountain ranges, shown in the map at the top of the page, which cut up the peninsula into a great number of more or less isolated valleys and plains.

The story of the coming of the Greeks into this land takes us back to about 1500 B.C., when wave after wave of barbarian invaders swept over the towns and cities of a great civilization, destroying it and then gradually building up a new civilization upon its ruins. About the splendid and far-flung

THE OSTRACISM OF ARISTIDES THE JUST



In democratic Athens unpopular statesmen were sometimes banished for a ten-year period. This was done by the process of "ostracism," named after the Greek word for "potsherd," because it was upon bits of broken pottery—the "scrap paper" of antiquity—that the voters wrote the name of the man they wanted banished. How unfairly the people sometimes used their power of ostracism is shown by the story told about the banishment of Aristides, the famous rival of Themistocles, which we see pictured above. An ignorant countryman has come to the voting place, and has asked a bystander to write the name of Aristides on his potsherd. That bystander is Aristides himself. "Has Aristides done you any injury?" he asks the countryman. "No," the other replies, "but I am tired of hearing him called 'the Just.'" So Aristides with a sad smile writes his own name.

culture which the rude Greek tribesmen found on their irruption into the Aegean basin—the Aegean civilization with its gold and bronze and pottery and paintings and its great palaces at Cnossus in Crete and at Mycenae and Tiryns on the mainland—you may read elsewhere (*see* Aegean Civilization). The Greeks who swept down from the north and overwhelmed these cities were simple nomadic herdsmen—a branch of the Indo-European race that had for centuries been drifting to the east and west from their home in the grass-lands east and northeast of the Caspian Sea (*see* Philology). The first wave of invaders were the fair-haired Acheans of whom we read in Homer. The Dorians, who composed the second wave, came perhaps three or four centuries later, subjugating in their turn their Achean kinsmen. Other tribes, the Aeolians and the Ionians, found homes chiefly on the islands and coasts of Asia Minor.

Life of the Early Wanderers

Something of the culture of the Aegean civilization these Greek—or, as the Greeks called themselves, Hellenic—invaders must have absorbed when they settled down and intermarried with the people they conquered. But, being still in the nomadic stage themselves, they were not fitted to come into the whole heritage of a city civilization. So of the earliest stages of the Greek settlement we know little, for these invaders were neither builders nor writers. But we may imagine them moving southward from their pasture lands along the Danube, driving their herds before them, bringing their families and primitive goods in rough ox-carts, stopping in one place just long enough to plant and harvest one crop. These families settle down in the pasture lands of the peninsula, gradually take up farming, and little by little form communities ruled by kings and elders.

At this point we can begin to picture them. For the background of the 'Iliad' and the 'Odyssey' is the background of the Age of the Kings (*see* Homer). We see the Acheans living very simply, a race devoted to warfare. Their weapons and their songs are the only splendid things they have, except for the gorgeous robes and the beautiful jewelry and metal work they bought from Phoenician traders (*see* Phoenicians). The palace of Odysseus is built of wood, a hall about a court. In this hall they cook and eat. Sometimes it gets very smoky, for there are no chimneys. And the bed of Odysseus is no work of the cabinet-maker's art, but a very rude affair wrought by Odysseus himself out of a living olive tree.

In the 'Iliad' we see Greeks from many cities—Sparta, Athens, Thebes, Argos, and the rest—all more or less united to fight their common foe, Troy in Asia Minor (*see* Trojan War). In historical times the Greeks were again able to work more or less together when the power of Persia threatened them all. But Greece never became a nation. The only patriotism the Greek ever knew was loyalty to his city. This seems particularly strange to us nowadays, because their cities were so small. All the people of all of them could be put into the city of New York and hardly show. Except Athens, probably no Greek city-state counted more than 20,000 citizens, and most of them were less than half that size.

The reason for this disunity we have already touched upon. Just as Europe today is chopped up into nations instead of being a few large political units as North America is, so on a smaller scale ancient Greece was divided by its mountain ranges. And even the plains thus inclosed were in many cases subdivided, containing several city-states each surrounding its acropolis or citadel. These flat-topped, inaccessible rocks or mounds—which will remind you of the mesas of New Mexico—are characteristic of Greece, and were first used as places of refuge. Dwellers of the Corinthian isthmus had the lofty Acrocorinthus, of Attica the acropolis of Athens, of the plain of Argolis the mound of Tiryns, and loftier still the Larissa of Argos. On these rocks they built their temples and their king's palace, and their houses clustered about the base.

Only in a few cases did the city-state push its holdings beyond very narrow limits. Athens held the whole plain of Attica and most of the Attic villagers were Athenian citizens. Argos conquered the plain of Argolis. Sparta made a conquest of Laconia and part of the fertile plain of Messenia, the conquered people being subjects, not citizens. Thebes attempted to be the ruling city of Boeotia, but never quite succeeded.

Similar city-states were found through all the Greek world, which had early flung its outposts throughout the Aegean basin and even beyond. There were Greeks in all the islands of the Aegean: in Thasos, famous for its gold mines; in Samothrace, Imbros, and Lemnos, long occupied by Athenian colonists; in Lesbos, "where burning Sappho loved and sang," and Scyros the island of Achilles; in Chios, Samos, and Rhodes, as well as in the nearer-lying Cyclades—so called (from the Greek word for 'circle") because they formed a circle around the sacred island of Delos—and to the south in the island of Crete. The western shores of Asia Minor were fringed with Greek colonies, reaching out past the Propontis (Sea of Marmora) and the Bosporus to the northern and southern shores of the Euxine or Black Sea. In Africa there were, among others, the colony of Cyrene, and the trading post of Naucratis in Egypt. Sicily too was colonized by the Greeks, and there and in southern Italy so many colonies were planted that this region came to be known as Magna Graecia, or "Great Greece." Pressing farther still, the Greeks founded the city of Massilia, now Marseilles, in Gaul.

The Lack of Political Unity

Separated by barriers of sea and mountain, by local pride and jealousy, the various independent city-states never even conceived the idea of forming a political unit of the Greek-speaking world, except as some powerful state embarked on a career of conquest

GREEK CHILDREN AT PLAY

The houses of the Greeks were usually built around a court, which was the "front yard" of the family and the playground of the children. Not only did the youngsters find swinging as delightful an amusement as do the children of today, but their games and toys were very much like our own. Here we see an idealized picture of a Greek home, one such as belonged perhaps to some rich Athenian. The costume of the woman at the left indicates that she is the children's nurse.

and attempted to make itself mistress of the rest. Many influences made for unity—a common language, a common religion (*see* Mythology), a common literature, similar manners and customs, the religious leagues and festivals, the Olympic Games (*see* Olympic Games)—but even in time of foreign invasion it was with the greatest difficulty that the cities were induced to act together.

The government of many of the city-states—notably Athens—passes through four stages as we watch it from Homer to historical times. During the 8th and 7th centuries B.C. the kings disappear, monarchy gives way to oligarchy, that is, the rule of the few. The power goes over to the wealthy land-owning nobles—the "Eupatrids" or well-born. But the rivalry among the nobles and the discontent of the oppressed masses are too great, and soon a third stage appears.

This third type of government is known as tyranny. Some Eupatrid suddenly seizes absolute power—usually by obtaining the favor of the people and promising to right the wrongs inflicted upon them by the other land-holding Eupatrids. He is known as a "tyrant," which among the Greeks was not a term of reproach, merely implying one who had seized kingly power without the qualification of royal descent. The tyrants of the 7th century were a stepping stone to democracy, or the rule of the people, which was nearly everywhere established in the 6th and 5th centuries. For it was the tyrant who taught the people their rights and their power.

By the beginning of the 5th century B.C. Athens had gone through these stages and emerged as a democracy—the first democracy in the history of the world. Between two and three centuries before this the kings had been displaced by officials called "archons," elected by the nobles, and the aristocratic form of government was established. About 621 B.C. an important step in the direction of democracy was taken, when the first written laws in Greece were compiled from the existing traditional laws. This reform was forced by the peasants to relieve them from the oppression of the nobles. But this code, which was so severe that the adjective "Draconic," from the name of its compiler Draco, is still a synonym for "harsh," did not give sufficient relief. A revolution was only averted by the wise reforms of Solon, about a generation later (*see* Solon). But Solon's reforms only put off the fatal day, and in 561 B.C. Pisistratus, aided by the discontented, made himself tyrant. With two interruptions, Pisistratus ruled for more than 30 years, fostering commerce, agriculture, and the arts, and laying the foundation for much of Athens' future greatness. His sons Hippias and Hipparchus attempted to continue their father's power, but one of them was slain by two youths, Harmodius and Aristogiton, who henceforth lived in Greek tradition as themes for sculptors and poets. By the reforms of Clisthenes, about 509, the nobles were shorn of much of their power, and the rule of the people was firmly established.

Very different was the course of events in Sparta (*see* Sparta), which had now established itself as the most powerful military state in Greece. Under the strict laws of Lycurgus (*see* Lycurgus) it had maintained its primitive monarchical form of government with little change. Nearly the whole of the Peloponnesus had been brought under its iron heel, and it was now jealously eyeing the rising power of its democratic rival in central Greece.

Suddenly there loomed in the east a thundercloud which threatened to sweep away the whole promising structure of the new European civilization. Persia, the great Asiatic world-empire of the day, had suddenly been awakened to the existence of the free peoples of Greece by the aid which the Athenians had sent to their oppressed kinsmen in Asia Minor. The dramatic story of how the scanty forces of the Greeks drove back the enormous Persian armaments is told in the article on the Persian Wars.

How Athens Rose to Power

From this momentous conflict Athens emerged a blackened ruin, but yet the richest and most powerful state in Greece. She owed this position chiefly to the shrewd policies of her statesman Themistocles, who had seen that naval strength, not land strength, was henceforth to be the key to power. "Whoso can hold the sea has command of the situation," he said. He persuaded his fellow Athenians to build a strong fleet —larger than the combined fleets of all the rest of Greece—and to fortify the harbor at Piraeus. This fleet became the instrument by which the Persians were finally defeated at the battle of Salamis, and also by which Athens made herself mistress of the Aegean. For, within three years after Salamis (480 B.C.), Athens had united the Greek cities of the Asiatic coast and of the Aegean islands into a confederacy (called the Delian League because the treasury was at first on the island of Delos) for defense against Persia; and in another generation this confederacy had become an Athenian Empire.

Almost at a stride Athens was transformed from a provincial city to an imperial capital. The bewildering rapidity of her leap to power makes us think of the transformation of Japan in the second half of the 19th century. Wealth beyond the dreams of any other Greek state flowed into her coffers—tribute from subject and allied states, customs duties on the flood of commerce that poured through the Piraeus, and revenues from the Attic silver mines. The population increased fourfold or more, as foreigners streamed in to share in the prosperity. Learning and the arts flourished as never before in history. Painters and sculptors vied in beautifying Athens with the works of their genius—treasures which even today, battered and defaced by time and man, still remain among the wonder works of human skill.

This period, which stands out as one of the most remarkable and brilliant in the world's history, reached its culmination in the age of Pericles, 460–430 B.C. (*see* Pericles). Under the stimulus of wealth, power, abundant leisure, and free institutions, the citizen body of Athens attained a higher average of intelligence than any other society before or since. Sir Francis Galton, the eminent English scientist and anthropologist, says of them: "The average ability of the Athenian race is, on the lowest possible estimate, very nearly two grades higher than our own, that is, about as much as our race is above that of the African negro. This estimate is confirmed by the quick intelligence and high culture of the Athenian commonalty, before whom literary works were recited and works of art exhibited of a far more severe character than could possibly be appreciated by the average of our race."

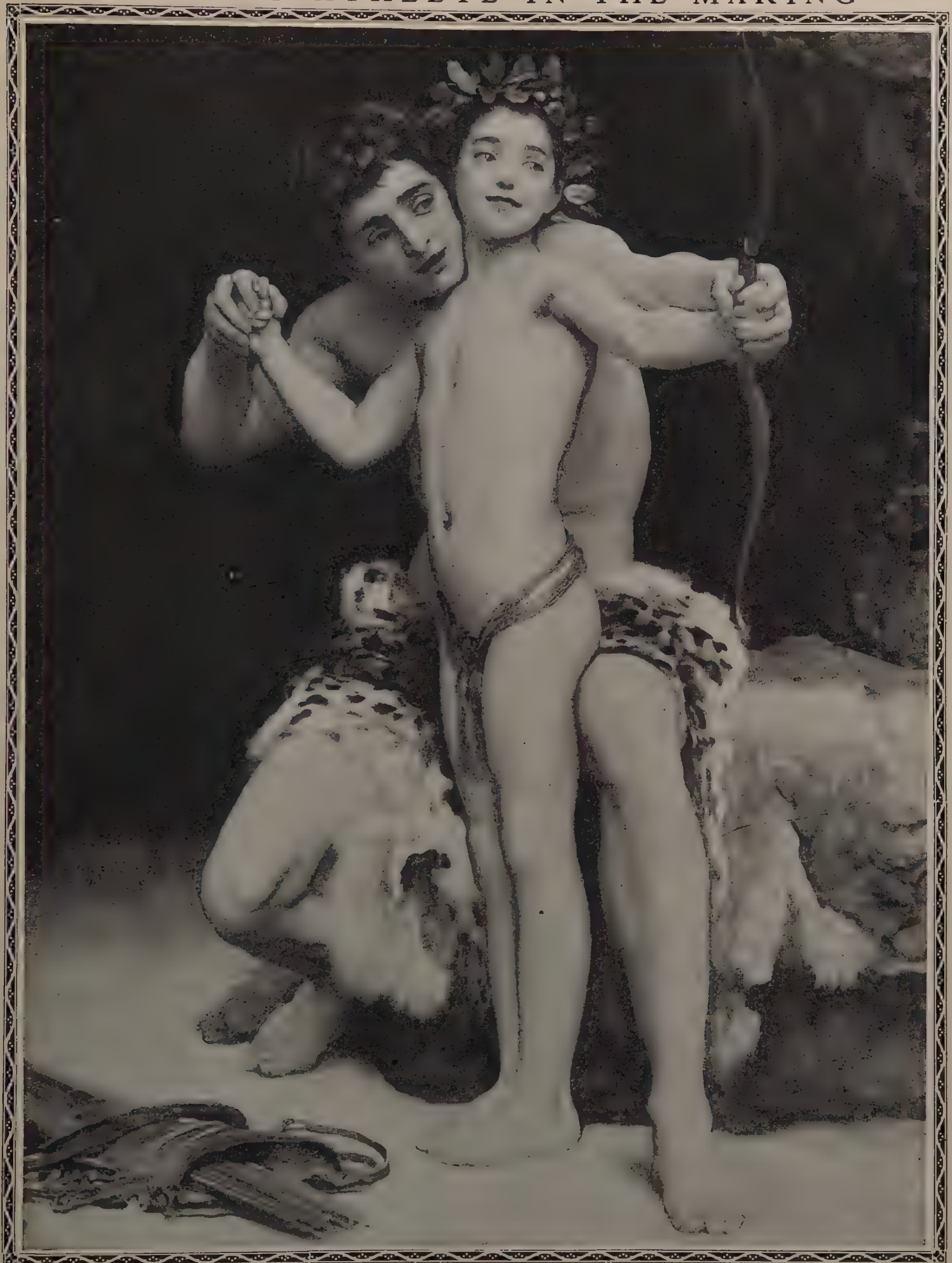
But we must remember that a very large part of the Athenian population were not citizens, for the Athenian state rested on a foundation of slavery. Two-fifths (some authorities say four-fifths) of the population were slaves (often if not usually themselves of Greek blood) whose labor produced a large part of the wealth that gave the citizen the time and money to pursue art and learning and serve the state.

Slavery in Greece was a peculiar institution. When a city was conquered its inhabitants were often sold as slaves. Kidnaping boys and men in "barbarian," that is, non-Greek lands, and even in other Greek states, was another steady source of supply. If a slave was well educated or could be trained to a craft, he was easily disposed of. And a slave always had a chance of obtaining his freedom, for quite frequently his master would let him work for hire and this gave him a chance to save money. After he had bought his freedom or had been set free by a grateful master, he became simply a "metic"—a resident alien. Many of the slaves who could not be trained, however, had a miserable lot. They were sent in gangs to the silver mines at Laurium, where they worked underground by the dim light of little olive oil lamps in narrow corridors.

Life in the Periclean Age

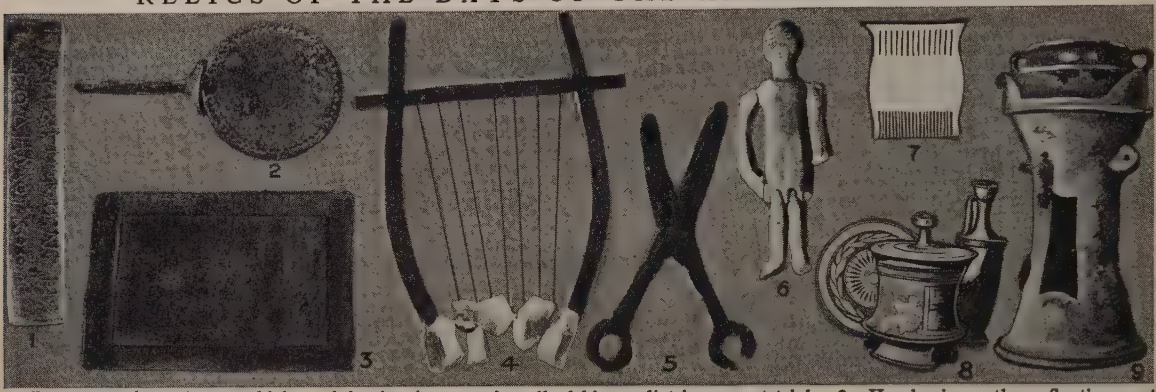
Though the citizens of Athens were thus set free from much of the drudgery of life, we must not get the idea that they reveled in luxury. "Plain living and high thinking" might have been their motto, for the standard of comfort was very low, in comparison with our own. The houses were of sun-dried brick, built two stories high along narrow winding streets, into which refuse was thrown instead of being properly drained or carted off. The people ate two meals a day, each consisting of bread, perhaps a broth of beans and pulse, with wine and sometimes

A YOUNG ATHLETE IN THE MAKING



Training of the body occupied just as important a place in the Greek system of education as the training of the mind, and that same fine and gracious character which marked other aspects of their life was also present in their athletic contests and games. This picture by Lord Leighton, former president of the British Royal Academy, shows a young man instructing a boy in the art of shooting with the bow.

RELICS OF THE DAYS OF THE ANCIENT GREEKS



1. Fragment of pottery on which an Athenian juryman inscribed his verdict in a court trial. 2. Hand mirror, the reflecting part made of polished metal. 3. Waxed tablet on which some Greek school boy had scratched his multiplication table. 4. Lyre. 5. A pair of scissors. 6. Doll made of clay. 7. Comb. 8. Platter, toilet box, and oil flask. 9. Movable oven with a cooking pot fitting into the top.

fruit to wash it down. Fish with the bread was thought to make a remarkably fine meal. Olives and olive oil were largely used; honey took the place of sugar; and cheese was often eaten in place of meat, but butter was practically unknown. Athens can be nearly as cold in winter as Philadelphia, yet the only heat in the houses was a brazier or dish of burning charcoal. There was no plumbing, nor were there chimneys, and the smoke from the stove in the tiny kitchen sometimes preferred wandering around the house to going out the hole in the roof provided for it. There were no windows on the first floor, but in the center of the house was a broad open court—as you will find in Spain or in the oriental countries today—with the men's apartment, the women's apartment, and the tiny cupboard-like bedrooms clustered about it. The second story sometimes had a window or two looking down upon the street.

The Gossip of the Market Place

But the real life of the city was out of doors. The men spent much of their time talking politics and philosophy in the agora or market place, exercising or lounging in the athletic fields, performing military duty, sitting in the Assembly or the Council of 500, taking part in the numerous state festivals, or doing jury duty—there were 6,000 jurors on duty all the time in Athens, for all the allied cities were forced to bring their cases to Athens for trial. Daily salaries were paid for jury service and service on the Council, which made up a considerable part of the income of the poorer citizens. The women stayed at home, attending to the affairs of the house and spinning and weaving the wool for clothing. They never acted as hostess when their husbands had parties, and were only seen in public at the theater—where they might attend tragedy but not comedy—and at certain religious festivals.

Such was life in Athens in the heyday of her glory, before the jealousy of Sparta and other independent Greek states, and the discontent of the subject states of the Athenian Empire, flamed up into a war that forever broke the power of Athens and left her a mere shadow of her former greatness. Already the first of the inevitable clashes between imperial Athens and her rivals, chief of whom was Sparta, had wasted the strength of most of Greece for 15 years of indecisive struggle. This was the first of the Peloponnesian Wars (459–446), which were to the Greek world what the World War of 1914–18 was to our own. In 431, in spite of the exhaustion of both sides, war again broke out.

The plan of Pericles in the Second Peloponnesian War was not to fight at all, but to let Corinth and Sparta spend their money and energies while Athens conserved both. Therefore he had all the inhabitants of Attica come inside the walls of Athens and let the Peloponnesians enter the plain of Attica year after year and ravage as they would, while Athens, again without losses, harried their lands by sea. But Pericles reckoned without the dangers of overcrowding. The plague broke out in Athens and killed one-fourth of the population, including Pericles himself, and left the other three-fourths without spirit and without a leader. After dragging along for ten years, this war ended with the supremacy still undecided.

Alcibiades and His Evil Influence

Almost before they knew it, however, the Athenians were whirled by the unscrupulous demagogue Alcibiades, nephew of Pericles, into the Third Peloponnesian War. Wishing for a brilliant military career Alcibiades persuaded Athens into a stupendous expedition against Syracuse, a Corinthian colony in Sicily. The greatness of the Athenian armament reminds us of the Invincible Armada that was sent by Spain against England in Queen Elizabeth's time. And it suffered an equally overwhelming disaster in 413 B.C., being completely destroyed, while the Athenian captives were sold into slavery.

This disaster sealed the fate of Athens. Those of the subjects or allied cities about the Aegean that had remained faithful now deserted to Sparta, and the Spartans laid Athens under siege. In 405 B.C. the whole remaining Athenian fleet of 180 triremes was captured in the Hellespont at the battle of Aegospotami. Besieged by land and powerless by sea, Athens could neither raise grain nor import it, and in 404 B.C. the Athenian Empire came to an end. The fortifications and long walls connecting Athens with Piraeus were destroyed, and Athens became a vassal ally of triumphant Sparta.

Sparta maintained its supremacy by keeping Spartan garrisons in many of the Greek cities, and this custom together with Sparta's hatred of democracy made its domination unpopular. After various unsuccessful attempts to shake off its heavy hand, Thebes at length succeeded (*see* Thebes). At the battle of Leuctra in 371 B.C. the Thebans under their gifted commander Epaminondas brought Spartan power to an end. The era of Theban hegemony or leadership was, however, short-lived, for the Theban power was the one-man power of Epaminondas, and when he was killed in the battle of Mantinea in 362 B.C. Thebes really suffered defeat in spite of its victory. The age of the powerful city-states was at an end, and a prostrated Greece invited a conqueror.

Such a conqueror was found in the young and strong country of Macedon, lying just to the north of classical Greece. Its king Philip, who came into power in 360 B.C., had had a Greek education and, seeing the weakness of the disunited cities, made up his mind to possess the Greek world. Demosthenes (*see* Demosthenes) saw the danger that threatened and by a series of fiery speeches against Philip sought to unite the Greeks as they had once been united against Persia. But Philip was too strong for them and at the battle of Chaeronea (338) established his leadership. Before he could carry his conquests to Asia Minor, however, he was killed and his power fell to his son Alexander, then not quite 20 years old. How Alexander firmly established himself throughout Greece, and then overthrew the vast power of Persia, building up an empire that embraced nearly the entire known world, is told in a separate article.

CLINGING CLOTH CARVED FROM THE SOLID STONE

These three figures from the ruins of the Parthenon in Athens, and now in the British Museum, are generally supposed to present the finest treatment of drapery known to the sculptor's art. Mutilated as they are, the exact meaning of these figures remains a mystery. They are commonly called "The Three Fates," but another interesting theory is that the reclining form is that of Thalassa "the Sea," lying in the lap of Gaia "the Earth," and that the exquisite flowing lines of drapery represent the waves breaking upon the shore. According to this theory, the figure at the left did not belong to the group.

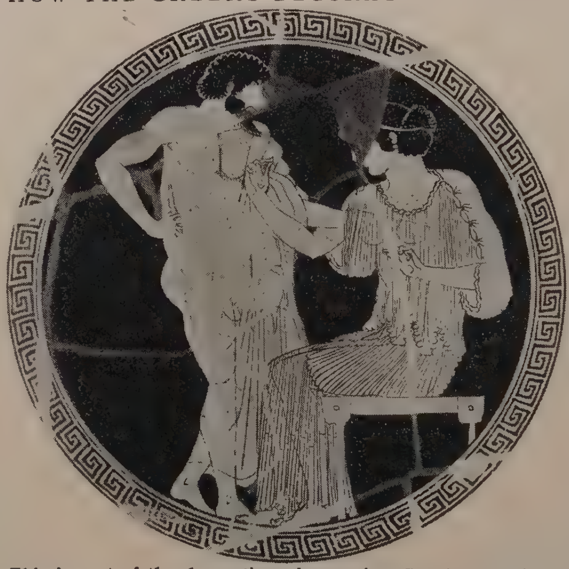
Alexander made the whole face of the world Greek as he organized his conquests. What he did is a heritage for us to this day, for by imposing the West upon the East he prevented the East's imposing itself upon the West. Greek culture means freedom of spirit, and, as the Romans put it, a healthy mind in a healthy body. The East was a great system of enslavement. Masses of weltering humanity were driven to battle by the lash. They were forced to build palaces under the tropical sun and to make sculptures of prodigious size for the glory of one man, but they took no such joy in any of their work as the Athenians did in their beautiful Acropolis.

The three centuries that follow the death of Alexander are known as the Hellenistic age, for their products were no longer pure Greek, but Greek plus the characteristics of the conquered nations. It was a time of great wealth and splendor. Art, science, and letters flourished and developed. The private citizen no longer lived crudely, but in a beautiful and comfortable house, and many cities adorned themselves with beautiful public buildings and sculptures.

This age came to its end in another conquest—that of Rome. On the field of Cynoscephalae ("dogs' heads"), in Thessaly, the Romans defeated Macedonia in 197 B.C. and gave the Greek cities their freedom as allies. Even so the Greeks caused Rome a great deal of trouble, and were taught their lesson by the burning of Corinth in 146 B.C. and their reduction to vassalage. Athens alone was revered and allowed a certain amount of freedom, and to its schools went many Romans, Cicero among them.

For more than 2,000 years, from the time of Alexander the Great to the third decade of the 19th century, the Greeks passed from one master to another. The last of these conquerors was Turkey, which established its dominion during the 15th century. At the beginning of the 19th century the power of Turkey was waning. Revolts by subject peoples and by the outlying parts of the empire itself were becoming more and more frequent. In 1821 the Greek nation as a whole, stirred by the example of the French Revolution, rose in arms in the Greek War of Independence. Russia was interested because the Greek Catholic church was also the state church of Russia, and Russia had for years claimed the right to protect the Greek Christian subjects of the Turkish Empire. Numerous volunteers from Europe joined the Greeks—Lord Byron among them — and fought the troops of the sultan with varying success. There were terrible massacres committed on both sides. In 1827 the Turkish fleet was destroyed at Navarino by the combined British, French, and Russian fleets, but there the joint action ceased. Next year Russia took matters into her own hands, marched an army into the Balkans, and took Adrianople. In the peace of Adrianople (1829) Turkey signed a peace whose outcome was the restoration of independence to the Greeks, after centuries of oppression by foreign powers.

HOW THE GREEKS DECORATED POTTERY



This is part of the decoration of an ancient Greek vase, pieced together from broken fragments. In this type of work the background was painted black, and the details of the figures sketched in with black lines, while the remainder was simply left in the color of the clay. The delicacy and sureness of line on these vases is universally admired.

In 1832 after serious disorders and the murder of its provisional president, the three protecting powers raised to the throne of Greece Prince Otto, son of Louis I of Bavaria. Otto, however, ruled after the German manner, with German advisers, and the Greeks in 1862 revolted and deposed him. In the following year Prince George of Denmark became king and reigned until his assassination in 1913. In 1864 Great Britain ceded to Greece the Ionian Islands, which had been a republic under British protection since 1815. The scanted original kingdom was further enlarged by the addition of Thessaly on the north, between 1881 and 1897. Crete, which had revolted from Turkish rule, was not allowed by the powers to become a part of Greece until 1913. Brigandage was not put down until 1870, and it was not until 1916 that the 56-mile link was completed that now connects the Greek railways with those of the rest of Europe.

In the Balkan War of 1912–13, the allied Balkan states thoroughly defeated Turkey, and Greece gained a broad strip of territory on the north, amounting to 21,000 square miles and including a great part of ancient Macedonia (*see* Balkan Peninsula). This was the greatest expansion the kingdom had experienced since its founding in 1862. In the World War of 1914–18 Greece proclaimed neutrality; but King Constantine, who was married to the sister of Emperor William II of Germany, was accused by the Allies of secretly aiding the Central Powers. Prime Minister Venizelos, a most brilliant statesman who had piloted his country through the Balkan Wars, revolted after he had twice been dismissed unconstitutionally by the king; and in June 1917, King Constantine was forced by the Allies to abdicate in favor of his second son, Alexander, and leave the country. In the peace settlement which followed the close of the war Venizelos obtained exceedingly favorable terms for Greece, including the annexation of Thrace to the Black Sea (including Adrianople), together with Smyrna and a large adjacent district in Asia Minor (for map *see* Balkan Peninsula). But in December 1920, following the death of Alexander from the bite of a pet monkey, Constantine was restored by an overwhelming vote of the Greek people, and thereby Greece forfeited the support of the Allied powers. The Greek government attempted single-handed to enforce their claims to the lands granted them in Asia Minor, but their armies were defeated by Turkish nationalists in 1921, and the whole position of Greece was shaken.

The Greek constitution adopted Oct. 29, 1864, placed the legislative power in the hands of a single assembly elected by manhood suffrage. In 1911 this constitution was modified to provide for a second chamber by reëstablishing the Council of State.

And now let us make a flying visit to the land whose fortunes we have been following through 30 centuries. Should you try to take a walking trip through Greece you will find, outside of Athens, few comfortable hotels. After an afternoon's tramp over stony roads, you will perhaps stop at some *khan*, and find that the cooking is done at the hearth before which you will roll yourself up in a blanket to sleep. At such country inns you will not find the delicious Greek-Turkish cookery of Athens—*pilaf*, which is rice prepared with minced mutton or chicken and pastry made with honey. You will be lucky to get coarse dark bread and goat's milk cheese, and a few preserved olives, washed down with the native wine which tastes strongly of the resin put in to preserve it.

visitor readily appreciates the beautiful location of what is now just a country town. It is surrounded by mountains, with the famous Helicon and Parnassus on the west. To the northwest lies Lake Copais, which formerly was a shallow and unhealthy sheet of water and marsh but now has been drained, redeeming 60,000 acres of fertile land.

The most interesting excavations in Greece are in the Peloponnesus at Olympia, which may be reached by rail from Corinth. As you journey along the Gulf of Corinth you will see luxuriant vineyards and dazzling white fields set apart for drying currants.

THE CITY OF ATHENS AS IT IS TODAY

We are looking across the tiled roofs of modern Athens at the Acropolis with the ruins of the Parthenon on its flat summit. In ancient Athens the favorite section for residences was in this region northeast of the Acropolis and the Athenians of today have followed the examples of their ancestors. In the foreground at the left is the Royal Palace.

An hour or so by train from Athens will take you to the mines at Laurium, from which came the silver to pay for Themistocles' "wooden wall"—the fleet which made Athens head of an empire. A Greek and a French company are working these mines today and a guide will take you through some of the 2,000 ancient galleries that lie side by side with the newer ones. The old slag heaps are being smelted over, not so much for silver as for lead and other metals that the ancient Greeks failed to extract.

Of Thebes and Corinth, the ancient neighbors and rivals of Athens, and of Sparta, the more distant enemy city, the earthquakes and other accidents of 2,000 years have left little now standing. But although the archaeologists have no hope of ever locating the famous seven gates of Thebes, the Tall dark cypresses and mountain torrents add to the beauty of the landscape. The currant industry became so profitable in the late 1870's when phylloxera attacked the vines of France that Greek agriculturists cut down their precious olive groves—it takes 60 years for an olive tree to reach maturity—in order that they might plant more currants. And ever since the French vines recovered, the Greek government has had the problem of superfluous currants to deal with. At first the government took over a percentage of the crop, but recently it has passed a law limiting production and ordering the digging up of thousands of acres of vines.

Olympia, like Pompeii, is a buried city which modern enterprise has brought to light. In the three centuries following the last celebration of the Olympic

Games, in the 4th century A.D., the chief temples were overthrown by earthquakes, the treasuries were covered by a landslip, and the whole site buried under two or three layers of sand by the two rivers at whose junction it lies. In the museum there you will find the original Hermes of Praxiteles, one of the greatest pieces of ancient sculpture that has come down to us.

Other important finds have been made at Delphi, once the site of the famous oracle (*see* Delphi). You will enjoy a visit to this beautiful spot on the northern shore of the Corinthian gulf, whose cold springs and cool air currents from the chasms of Mount Parnassus early excited the awe of the Greeks. You will be disappointed, however, if you have come with an old guide book, for the Castalian spring was filled up by an earthquake in 1894.

A visit to the little island of Aegina about 15 miles southwest of Athens will also be well worth while. This has a prosperous agricultural and fishing community, famous for its pottery, and for the sponge fishing carried on by divers in the spring and summer. But it is most interesting for the remains of its splendid temple of Zeus.

Some day when the Aegean Sea is propitious you will sail from the Piraeus to visit the Cyclades Islands, especially Delos. This little island, uninhabited today except by a few shepherds and the custodian of the excavations, is rich in archaeological interest—temples, a theater, and a house with a mosaic floor, and the fragments of a very old colossal statue of Apollo which stood in the sacred precinct near the Apollo temple, in the days of the Delian League. If you climb to the top of Mount Kynthos you can see other islands of the group round about, including Naxos, the largest and most fertile, and Paros, still famous for its marble.

Relics of Many Ages

Side by side with the antiquities of Greece you will often find Byzantine churches, medieval monasteries of the Greek Catholic church, and ruins of "Frankish" castles, erected in the days following the crusade of 1204, when barons from western Europe ruled parts of the land. In 1829 some 300 of the smaller monasteries were suppressed and their buildings allowed to fall into decay. But there are still scores of monasteries in Greece, and in traveling about you will often seek the hospitality of the monks instead of putting up at doubtful khans—even in Saloniki, the "queen city of the Aegean" (*see* Saloniki). The monasteries of the mountainous promontory of Athos are world famous, and the Meteora in Thessaly the most curious. The visitor is usually swung up the top of these rocky pinnacles by a basket and windlass, instead of being asked to climb the dizzy ladders.

The Greek Orthodox church, although nominally under the Patriarchiate of Constantinople, is really a free national church. Its growing separation from the Roman Catholic church, arising in part from differences of language and civilization, became definite in 1054. Aside from the refusal of the Greek church to recognize the supremacy of the pope, there are other differences—marriage allowed to Greek priests (forbidden to Roman Catholic clergy), use of leavened instead of unleavened bread in the sacrament of the Mass, a slight difference of doctrine concerning the Holy Ghost, etc.

The Greeks today are a scattered race, like the Jews; but in whatever part of the globe they may be they show an intense love of Greece. In one battle in the Balkan War 7,000 Greeks who were American citizens died fighting against the Bulgars; and it is the usual ideal of the Greeks whom we see in the United States in their little fruit, flower, and candy shops to make a sufficient fortune to enable them to go back to Greece to live.

Races of Modern Greece

In addition to the Greek-speaking element of the population, which represents the parent Greek stock much modified by Slavic and other racial mixtures, Greece today is inhabited by two other wholly distinct racial groups. All over the Attic plain, Corinthia, Argolis, and in various other parts, are found the Albanians, who are chiefly farmers. They are a vigorous and manly race, who make excellent soldiers and sailors and have furnished many famous leaders to the kingdom, though they are less quick-witted than the true Greeks (*see* Albania). The Vlachs, who are found chiefly in the mountains of Thessaly and central Greece, are for the most part nomad herdsmen or carriers; descended from the Latinized population of Roman times, they still speak a language which indicates its Latin origin.

More than half the people are employed in agriculture and kindred pursuits. Owing to the destruction of the forests, and the consequent denudation of the soil and impoverishment of water supply, the arable area is considerably less than in classical times. Where there is sufficient natural water, or where irrigation is practiced, however, bountiful crops are raised. More than half the arable area is devoted to stock-raising, chiefly sheep and goats, as of old. One-fifth of the surface of the mainland is still forested. Methods of agriculture are still for the most part of the most primitive kind. In many places the old wooden plow—precisely as it was 2,500 years ago—is still employed. The use of fertilizers and rotation of crops is rare, and the fields are generally allowed to lie fallow in alternate years. The result is that Greece has to import a considerable proportion of its food, especially cereals.

The absence of good native coal has retarded manufacturing, though textiles, leather goods, soap, paper, glass, and some other articles are manufactured, in addition to olive oil and wine. Shipbuilding is carried on at all the ports, for a large part of the nation's wealth today comes from its carrying trade. The Greeks are shrewd traders and monopolize a considerable proportion of the commerce of the Mediterranean region.

The GLORIOUS ART *of* GREECE *and How* ROME *Helped Transmit It to Us*

THE poet tells us that "A thing of beauty is a joy forever." More than 20 centuries ago the ancient Greeks, inspired by lofty ideals of Beauty, Truth, and Goodness, which in their simple and harmonious view of life were inseparable, created works of art which have never been equaled. Worn and defaced by time, these art works are still so beautiful that to look upon them is an inspiration. Many men have spent the best part of their lives searching for these beautiful fragments and thus helping to piece out the story of Greek art. Something of this wonderful story — the conditions under which Greek art was born, its development, and the great masters and their work—is told in this article. It tells, too, how when Greece fell her beauty held captive the practical-minded Roman conquerors; how, under her influence, the Romans developed an art of their own, and also helped to transmit to later ages the unsurpassed glory of the art of the Greeks.

GREEK AND ROMAN ART. Greek art owes a great deal to natural conditions. Greece is one of the fairest lands in all the world; nowhere else has Nature brought together the charm of mountains and sea and sky in more beautiful combination. The firm lines of mountains and crags outlined in the crystal-clear air against the brilliant blue of the sky must have helped to inspire that love of simple graceful line, of perfect proportion and symmetry, of strength and serenity, which is characteristic of Greek architecture and sculpture. Responding to the beauty that was everywhere about him, the Greek aspired to make his mind and his body harmonious and beautiful as Nature. It is impossible to measure how much the sculptor owed to the Greek emphasis of physical culture and athletics. And Nature endowed the Greeks in another important way; for many of the islands off the coast, notably Paros, are almost solid blocks of white marble, while in Attica the quarries of Mount Pentelicus and Mount Hymettus also yield an abundance of the beautiful white stone which invites the sculptor's chisel.

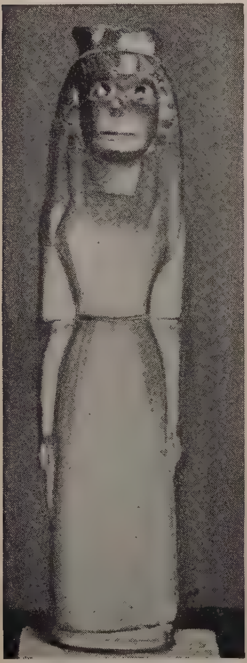
But we must not think that cold white marble alone satisfied the Greeks. They used color in both their sculpture and their architecture, though time has almost entirely washed away the reds and blues and other bright hues with which they touched up their work, and we can only imagine what the effect must have been when those works were in their prime. The work of the great Greek painters also has disappeared, and lives only in what the ancient writers tell us about it and in the work of their disciples of a later day. Polygnotus in the 5th century, we are told, was renowned as a draughtsman; while the great painters of the 4th century—Parrhasius, Zeuxis, and Apelles—were famous as colorists.

Fortunately many Greek vases have been preserved in tombs and in other sites uncovered by modern excavators. Simple and graceful in form, these vases show in the earliest specimens geometric designs; then figures of men and gods, painted in black against the natural red of the clay, or, as later became more common, with the figures left red against a black background. From these vases we are able to form some idea of what Greek painting was like, and they give us further examples of that wonderful feeling for form and line which made the Greeks supreme in the field of sculpture.

We must not imagine that Greek art sprang fullblown into being. The ancestors of those artists who were to create the most perfect forms of sculpture that the world has ever seen were a semi-barbarous people, when they began to migrate into the peninsula that is now Greece; and centuries rolled by before their genius flowered into the art forms which have been the admiration of all later times. Though they must unconsciously have been influenced by the art of the Aegean peoples whom they overwhelmed, no relation can be traced between the well-wrought figures and reliefs of Tiryns and Mycenae and Cnossus, and the crude beginnings of Helleric sculpture in the 7th century B.C. When we see how primitive and stiff are the Greek statues of that archaic period, and compare them with the masterpieces of two centuries later, we cannot but marvel at the rapid development of Greek art, when once it got fairly under way. Through the Phoenicians, the great trafficking race of the age, the early Greeks came in contact with the art of Babylonia, Assyria, and Egypt. They borrowed many of their decorative forms from these peoples, but transformed them by the fires of their own superb powers.

Greek religion, Greek love of beauty, and a growing spirit of nationality were finding fuller and fuller expression. But it took a storm like the Persian invasion (490–479 B.C.) to arouse the young virile race to great achievements. Having driven out the Asiatic invader, the Greeks suddenly grew, in the 5th century, to full stature. What the Persians had destroyed the Greeks set to work to rebuild. Their poets sang the glories of the new epoch, and Greek genius, as shown in the great creations at Athens, came to full strength and beauty. It was then, under Pericles, the great statesman and patron of art, that the Athenian Acropolis was restored and adorned with the matchless Parthenon, the Erechtheum, and other beautiful buildings. (*See* Acropolis; Athens.) There were beautiful temples in other cities of Greece, too, notably that of Zeus at Olympia, which we know from descriptions by the ancient writers and from a few fragments that have been discovered in recent times. (For Greek architecture *see* Architecture.)

AN ANCESTOR OF THE VENUS DE MILO



This quaint old lady is an example of very early Greek sculpture. It is hard to realize that from such crude beginnings developed the art which created the Venus de Milo.

The 5th century was made illustrious in sculpture also by the work of three great masters, all known to us in some degree by surviving works. Myron is famous for the boldness with which he fixed moments of violent action in marble, as in his famous 'Discobolus', or Disk-Thrower, which we know through a fine copy preserved at Rome. The 'Doryphorus', or Spear-Bearer, of Polyclitus, who worked in bronze, was called by the ancients the Rule, or guide in composition, because it was believed to follow the true proportions of the human body more perfectly than any other work.

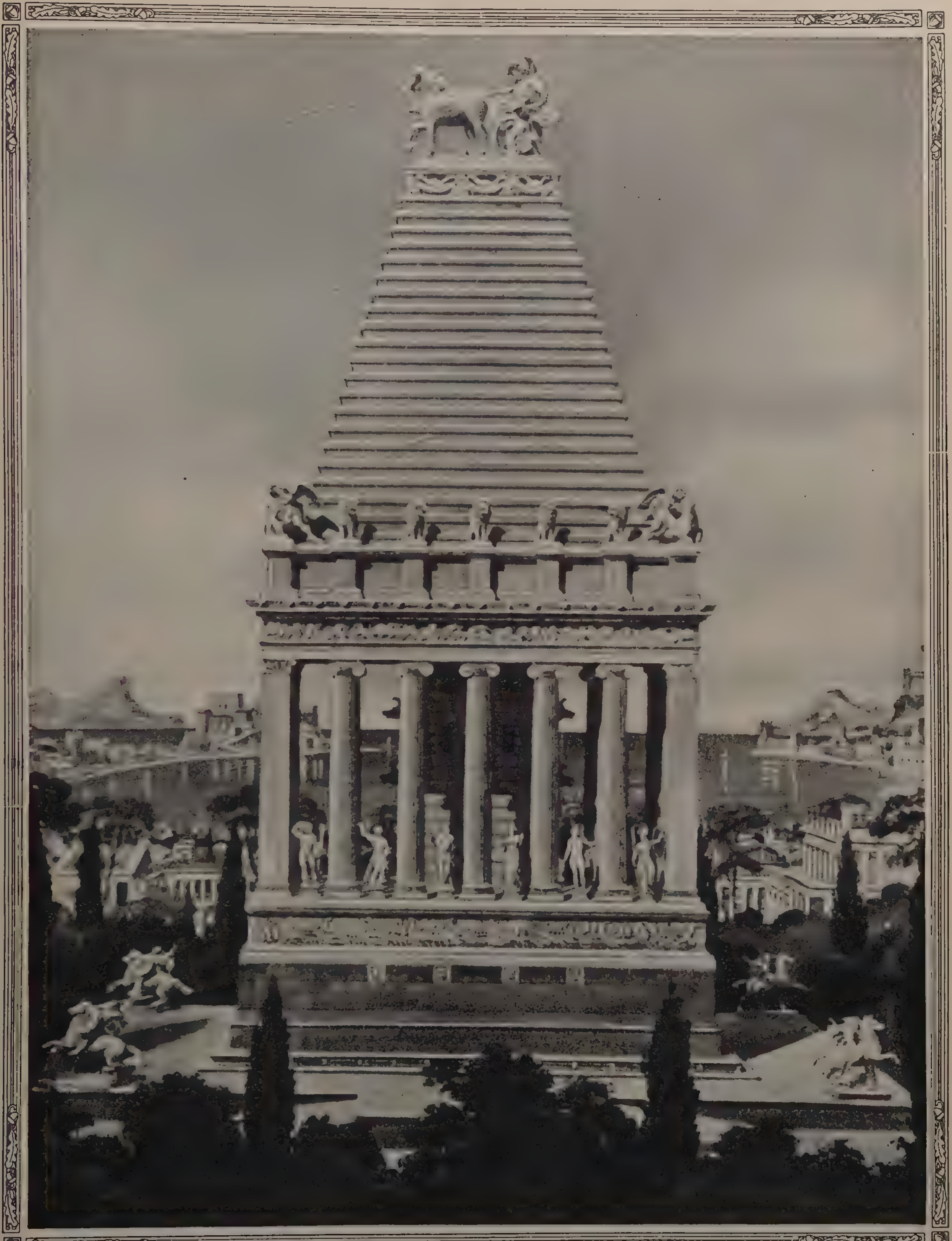
But the greatest name in Greek sculpture is that of Phidias, who expressed in his marvelous works the noblest and loftiest ideals of Greek religion (*see* Phidias). It was under his direction that the sculptures decorating the Parthenon were planned and executed, and some of them may have been the work of his own hand. His great masterpieces, the colossal gold and ivory statue of Athena, which stood within this temple, and the similar one of Zeus in the temple at Olympia, have disappeared. But we can form some conception of his great genius from the remains of the sculptures of the pediments and frieze of the Parthenon, now preserved in the British Museum and known as the Elgin Marbles, from Lord Elgin who brought them from Athens in 1801–12. These sculptures, in their composition, in their exquisite modeling, and in the noble ideas which they embody, are the greatest works of Greek art that have come down to us. Another famous work that is believed to belong to the school of Phidias is the 'Aphrodite' of Melos, commonly known as the Venus de Milo, a marble statue now in the Louvre in Paris. Although some think it belongs to a later date, its perfect proportions, its calm dignity, and noble serenity typify the qualities which we associate with Phidias.

Phidias was followed by Praxiteles, Scopas, and Lysippus. Of Praxiteles, who has been called "the sculptor of the beautiful," we have an original work, the statue of 'Hermes with the Child Dionysus', the only existing statue which we know certainly to be the work of one of the great Greek masters. Most of the sculptors, it must be remembered, are known to us only through copies of their work by Roman artists. The figure of Hermes, at once strong and active and graceful, beautifully proportioned, with a surface of exquisite texture, the well-poised head and the face expressive of nobility and sweetness, is beautiful beyond description. The child which is held in the left hand is reaching out to grasp something, perhaps a bunch of grapes—held in the missing hand of Hermes. The so-called Satyr or Faun of Praxiteles, which suggested Hawthorne's 'Marble Faun', is probably the work of another sculptor of

THE GOD OF WAR AT REST

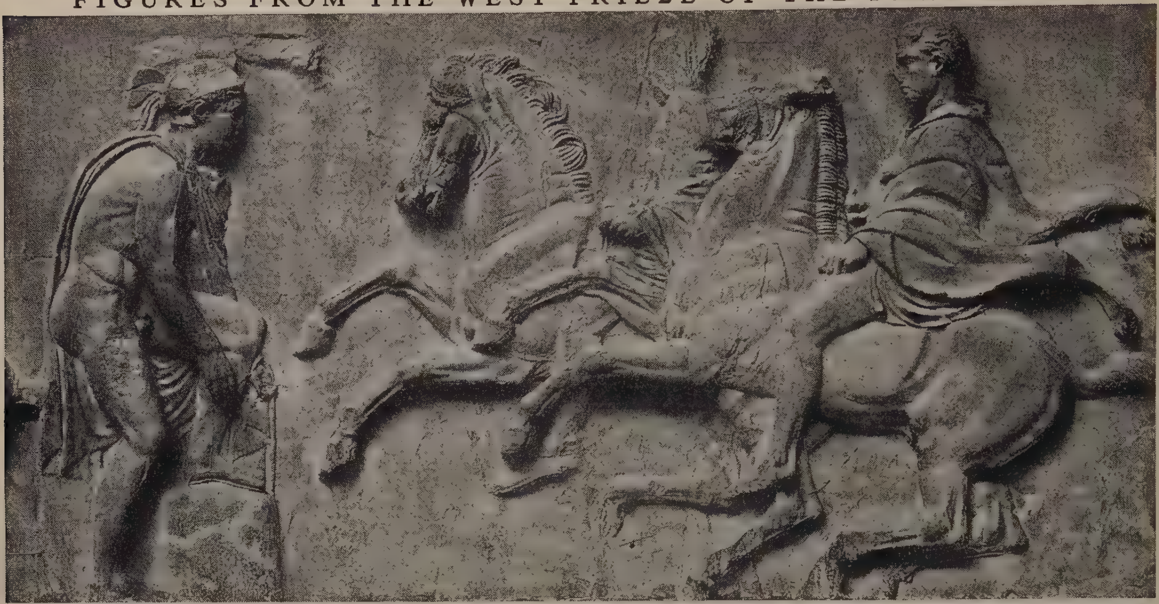
Compare this wonderful statue of the god Ares (Mars) with the crude figure at the left, and you will appreciate what progress the Greeks made in art in the course of a few centuries. This statue, the famous 'Villa Ludovisi Mars', is believed to be a copy of an original by Scopas or Lysippus. It is an excellent example of the characteristic "restraint" of Greek art. To show the violent character of the God of War, the sculptor merely extended the breadth of his nostrils, as men dilate them in anger. Playing at his feet is the little God of Love.

THE MOST FAMOUS TOMB OF ANCIENT TIMES



This tomb was built about 350 B.C. at Halicarnassus for King Mausolus of Caria by his widow, Artemisia. It was one of the Seven Wonders of the World, and one of the finest products of later Greek art. Designed by the architect and sculptor Pythis, it was richly adorned by Scopas and other noted sculptors. So great was the fame of this tomb that down to our own day all large and imposing burial places are called "mausoleums," after the ancient king whose bones rested here. This picture is an ideal restoration from the ruins.

FIGURES FROM THE WEST FRIEZE OF THE PARTHENON



Greek Art reached its climax in the Parthenon. Here we see three of the figures in the frieze on the west front, where the great "Panathenaic Procession" is represented as starting. Here the young soldiers are mounting or preparing to mount, one of them stooping to fasten his sandal. Notice the spirited action of these classic steeds of stone. The Greeks did not think it appropriate for horses to walk quietly in a procession. To do justice to the occasion they felt horses should prance and rear.

the same school. Praxiteles' conceptions are less lofty and dignified than those of Phidias, but they are full of grace and charm. Scopas carried further the tendency to portray dramatic moods, giving his subjects an intense impassioned expression. Lysippus returned to the athletic type of Polyclitus, but made his figures lighter and more slender, combining manly beauty and strength. He was at the height of his fame in the time of Alexander the Great, who, it is said, desired that Lysippus only should portray him. How far this age had advanced in the expression of graceful motion through the modeling of the figure and the skilful handling of the drapery can be seen in the celebrated 'Winged Victory' of Samothrace, now in the Louvre.

As time went on, Greek art lost much of its simplicity and ideal perfection of form, its serenity and restraint, but it gained in intensity of feeling, in expressing physical suffering and anguish. It had also become more realistic, portraying not only ideal types of men and gods but portraits of individuals, and not only Greeks but barbarians as well. One of the most famous works of the period after the death of Alexander is the 'Dying Gaul' sometimes called the 'Dying Gladiator'. In the 'Laocoön' group, which depicts the father and his sons crushed to death by deadly serpents, we find the extremity of physical torture as represented in sculpture. To this period belongs also the famous 'Apollo Belvedere', a statue of very great beauty, though it has lost something of the vigor and the calm power of the more heroic days. (*See* illustration on page 156.)

THE YOUNG AUGUSTUS

A fine example of Roman portrait sculpture

The Art of the Romans

From early times the Romans had felt the artistic influence of Greece, and when in 146 B.C. Greece was finally conquered by Rome, Greek art became inseparably interwoven with that of Rome. "Greece, conquered, led her conqueror captive"—this is the poet's way of expressing the triumph of Greek over Roman culture. But it is a mistake to suppose that the Romans were merely imitators, or that Roman art was merely a decayed form into which Greek art had fallen.

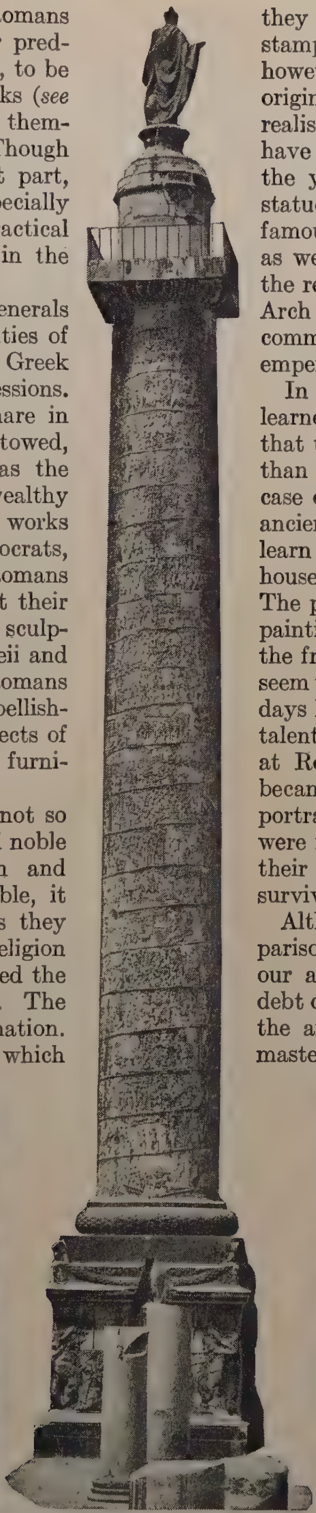
To a large extent the art of the Romans was a development of that of their predecessors in Italy, the Etruscans, who, to be sure, had learned much from the Greeks (*see* Etruscans). Nor were the Romans themselves entirely without originality. Though their artistic forms were, for the most part, borrowed, they expressed in them, especially in their architecture, their own practical dominating spirit, as you may read in the article on Architecture.

In the 2d century B.C. the Roman generals began a systematic plunder of the cities of Greece, bringing back thousands of Greek statues to grace their triumphal processions. Greek artists flocked to Rome to share in the patronage that was so lavishly bestowed, owing to the rich conquests made as the Roman power was extended. The wealthy Romans built villas, filled them with works of art in the manner of our modern plutocrats, and called for Greek artists or Romans inspired by Greek traditions to paint their walls and decorate their courts with sculptures. The ruins excavated at Pompeii and Herculaneum show us how fond the Romans and their neighbors in Italy were of embellishing not only their houses, but the objects of daily use, such as household utensils, furniture, etc. (*see* Pompeii).

But with the Romans art was used not so much for the expression of great and noble ideas and emotions as for decoration and ostentation. As art became fashionable, it lost much of its spiritual quality. As they borrowed many elements of their religion from the Greeks, so the Romans copied the statues of Greek gods and goddesses. The Romans were lacking in great imagination. Even in one of the few ideal types which they originated, the 'Antinoüs', the Greek stamp is unmistakable. In one respect, however, the Roman sculptors did show originality; they produced many vigorous realistic portrait statues. Among those that have come down to us are a beautiful bust of the young Augustus, a splendid full-length statue of the same emperor, and busts of other famous statesmen. All these have a historic as well as an artistic value. So, too, have the reliefs which adorn such structures as the Arch of Titus and the Column of Trajan, commemorating great events in these emperors' reigns.

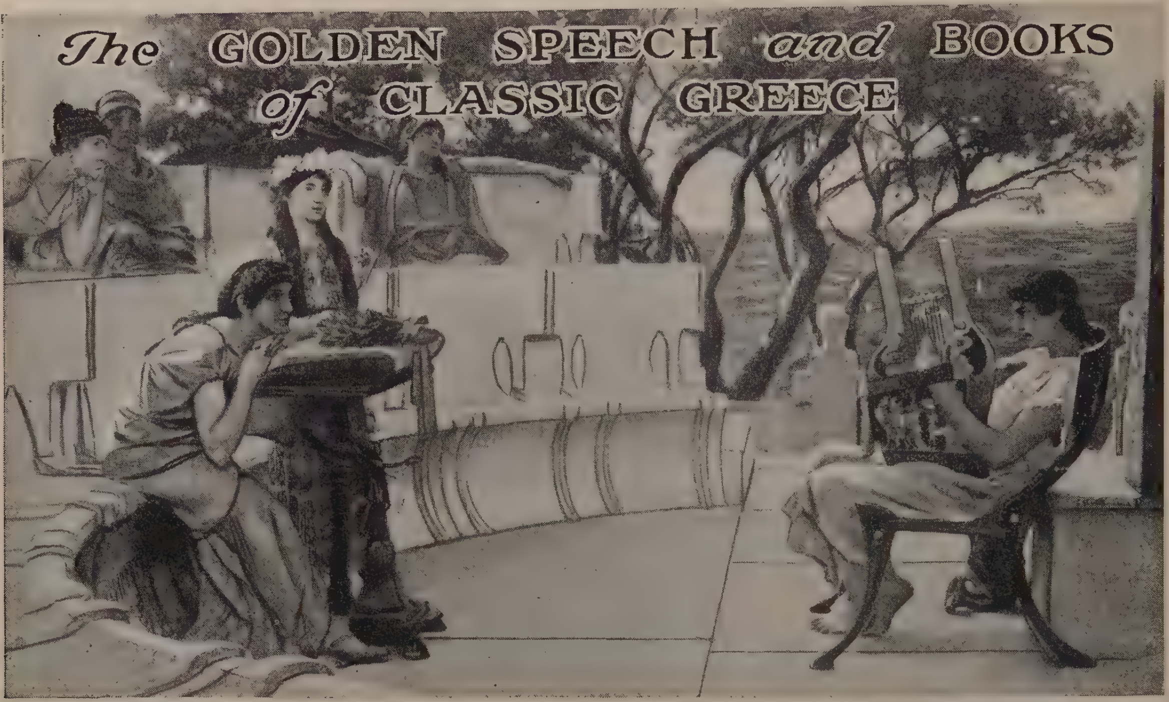
In painting—though here, too, they learned from the Greeks—it seems probable that the Romans developed more originality than in sculpture. Unfortunately, as in the case of the Greeks, the great masterpieces of ancient painting no longer exist; but we can learn much from the mural paintings found in houses at Pompeii, Herculaneum, and Rome. The pleasing coloring, which in many of the paintings still remains fresh and vivid, and the freedom and vigor of the drawing, would seem to indicate that even from these ancient days Italy was the home of painters of great talent. Portrait painting especially flourished at Rome, where hack street-corner artists became so common that one could have his portrait painted for a few cents. These were more remarkable for their realistic than their artistic merit, as we know from several surviving examples.

Although the art of Rome loses in comparison with that of Greece, still it commands our admiration, and we owe the Romans a debt of gratitude for helping to transmit to us the art of the Greeks, who were their great masters.



Trajan's Column is at once a sublime expression of Roman Art and of the dominating force of the conquerors of the World. If you should go to Rome one of these days, you will see it towering into the air nearly a hundred feet high. Running around the shaft spirally in 23 tiers are some 25,000 figures done in relief. They represent the victories of the emperor Trajan. Portions of this relief are shown on each side of our picture. Under this column, in a golden urn, the ashes of the Emperor were buried. On the summit there was originally a colossal bronze statue of him, which Pope Sixtus V replaced with the figure of St. Peter.

The GOLDEN SPEECH and BOOKS of CLASSIC GREECE



Typical of the spirit of Greece is this painting, by Alma-Tadema, showing the poet Sappho, seated at the left, listening to the music of a lyre. The beauty of the fragments which we have of her work fully justifies the esteem in which the Greeks held her.

GREEK LANGUAGE AND LITERATURE. If Solon and Pericles could wander back from the Elysian Fields and sit down in some café of modern Athens they would probably be surprised to find how easily they could read the morning paper. Of course, it would take them a minute to focus their eyes on the print, so much smaller than anything done with the reed pen of their day, and they would find the shape of some of the letters changed or standardized. They would find many new words, and perhaps they would accuse the journalist of careless grammar. But all the same the literary Greek of today is perfectly intelligible to anyone who knows his Greek of 2,500 years ago. Their greatest trouble would be in ordering breakfast and talking with people about them. For many words concerning the intimate things of daily life were borrowed during medieval and modern times from the Italians, Turks, or other neighbors, and the pronunciation is so changed as to make modern spoken Greek almost unintelligible to one acquainted with only the classical tongue.

Greek nevertheless should be considered not as a dead language but as a living one. The Greek schoolboy can read the literary masterpieces of 2,500 years ago far more easily than we can read Chaucer. And the Greek language is living not only among modern Greeks, but in the up-to-date speech of America and the rest of the world. When we want to make a new word for a new thing we are likely to borrow from the Greek. For example, "osteopathy," "phonograph," "telegraph," "telephone," "automobile," "periscope," "photograph," and scores of other words that have found their way into our dictionaries to name modern inventions and developments of science are formed directly from old Greek words. Nor are we indebted to Greek only for these "made" words. Many are also woven into the very warp and woof of our language, as is told in the article on English Language. So, if you know Greek, you can often see at a glance the meaning and pronunciation of a word that would otherwise make you gasp—"anthropomorphic," for instance, which comes from the Greek words for "man" and "form," meaning therefore "man-formed" or "manlike."

But even if Greek were as dead as Sanskrit from the viewpoint of modern life, still it would be worth while for us to study it. For of all the languages of the world, the most beautiful is Greek as it was written 20 centuries or more ago. It was graceful and harmonious, full of light and shade and color, subtlety and music. It could pile words together into compounds with as great abandon as German does nowadays—only the words were prettier to begin with—or it could sail along with little words like a lightly moving skiff.

Moreover in this superb tongue was written one of the most wonderful literatures of all time. Of this literature we can only get half an idea even through the most careful translations. Poetry is always hard to translate, but Greek poetry loses more than perhaps any other, since English often takes two or three times as many words to say the same thing. A prose translation of Homer is therefore clumsy, and a translation in English verse is inadequate. Neither gives any idea of the simplicity and resonance and movement, the inevitability which never becomes monotony. The lyrics are even harder to translate, though Swinburne and Tennyson have produced free renderings of great beauty which give the English reader some notion of the qualities of the originals.

A SCENE FROM GREEK TRAGEDY

This painting by a modern German artist interprets a moving scene in the play 'Oedipus at Colonus', written by that mighty tragic poet, Sophocles. The blind old Oedipus, formerly king of Thebes, but now a wanderer on the face of the earth, has just addressed to his daughter Antigone the opening line of the tragedy, "Child of a blind old man, Antigone, what country reach we?"

Greek prose also loses much by translation, for Greek is a so much subtler instrument of expression than English that you would need a footnote to almost every word of a translation to explain the exact shade of meaning that your Greek author intended. The Greek "particles", for instance, little words only a letter or two long and amounting only to a slight gesture of the hand or the flicker of expression on a person's face, must be translated in English by some such awkward word as "moreover." A translation makes things tedious where the Greek expresses them compactly. This of course is because Greek is a rather highly "inflected" language. A single word of perhaps no more than two syllables, in Greek, may become a whole sentence with us.

The oldest Greek literary works that we have are the 'Iliad' and the 'Odyssey' of Homer, which the world still acknowledges as the most splendid examples of epic or narrative poetry. People used to wonder how first poems could be so perfect and so great as the 'Iliad' and the 'Odyssey'. The explanation is of course that these were not the first poems. They come from an age that was already rich in "folk" poetry—hymns to the gods and marriage hymns and lays telling the deeds of ancient heroes. In that age, however, the Greeks had no writing and of all the songs that the wandering bards carried from city to city and recited from memory, only the Homeric poems survived to be written down. The only exceptions are a few of the so-called Homeric hymns—the invocations to Apollo or some other god, with which it was customary for the singer to prelude his recitation of the Homeric stories themselves. The article on Homer tells you about these thrilling tales of adventure and also indicates where in these volumes you may find some of these stories retold.

From a slightly later period we have the poems attributed to Hesiod. Hesiod is a much more definite figure than Homer. He lived at the wretched hamlet of Ascra near Mount Helicon in Boeotia, probably in the 8th century B.C., and drew many faithful pictures of the dull poverty-stricken country life he knew so well. Homer and Hesiod together made a sort of bible for the Greeks—Homer telling the story of the heroic past, and Hesiod dealing with the practical realities of daily life, setting forth homely maxims and precepts for the farmer in his 'Works and Days', and in the 'Theogony' piecing together the old legends to form a systematic account of creation and the gods.

With the 8th and 7th centuries we come to the beginnings of the historical period. The old ways of life were giving way to new. Commerce, discovery, colonization, political change, widened the horizon of the Greeks and quickened their feeling and imagination. To express the thoughts and feelings aroused by this fuller and more interesting life, new literary forms were invented—all still in verse, however, for prose had not begun to be used as a literary medium. Instead of the rapid flowing "hexameter" (a line of six measures), so well adapted for narration, the poets of the 8th and 7th centuries used the meter called "elegaic," which lent itself to direct self-expression on almost any theme—patriotism, war, mourning, or political reflection—and the "iambic" meter, which was especially adapted to pointed personal utterance, usually of a satirical nature. With these forms are associated such names as Archilochus, Mimnermus, and Solon, the great lawgiver of Athens.

> *"To Greece we owe the love of Science, the love of Art, the love of Freedom. The Greek genius is the European genius in its first and brightest bloom. From a vivifying contact with the Greek spirit Europe derived that new and mighty impulse which we call Progress. If we reckon up our secular possessions, the wealth and heritage of the past, the larger share may be traced back to Greece."—S. H. Butcher.*
>
> *"The Greeks, we should never forget, were the first people to show the world what real freedom and real civilization were. And they brought, not only Politics, but Art and Science and Literature of every kind to a higher pitch than any other people ever did without borrowing from others."—E. A. Freeman.*
>
> *"The thoughts of the great Greek thinkers have been bearing fruit in the world ever since they were first uttered. In some special sciences, the work done by the Greeks remains a basis of study to this day. In Greek literature we have the fountain-head of all Western literature."—R. C. Jebb.*

More varied, flexible, and complex than these forms of verse was the type which the Greeks called "melic" and we call "lyric," because it was sung to the accompaniment of the lyre or the flute. With a free rhythmic structure, capable of the most subtle variation, Greek lyric reached a degree of artistic perfection never surpassed. Religious and processional hymns, odes of victory, dirges, wedding songs, drinking songs, love poems, were poured out by artists of exquisite skill, most of whom are known to us only by fragments. Greatest of them all was Pindar (518–446?), whose magnificent odes yield the scholar a pleasure which alone is enough to recompense for the labor of learning the Greek language. Sappho, who wrote about a century before Pindar, is generally esteemed as the greatest of all women poets. Her "every word," a famous critic says, "has a peculiar and unmistakable perfume, a seal of absolute perfection, and inimitable grace."

As the Greeks invented the epic and lyric forms, and brought them to a perfection which has never been surpassed, so too they invented the drama (considered as a literary form) and produced the masterpieces which are still reckoned as the drama's crowning achievements. In the crowded glorious age which followed the repulse of Persia (490–479), the awakened national consciousness of Athens found expression in a series of superb tragedies which have never been equaled except perhaps by a few of Shakespeare's. The story of how the simple choral songs and dialogues performed at the festivals of the god Dionysus flowered into the majestic tragedies of Aeschylus, Sophocles, and Euripides, and how each made improvements in the dramatic form, is told in the article on Drama.

The religious character which was impressed on Greek drama by its origin was never lost. It was acted only at the festivals held in honor of Dionysus, and wealthy citizens were chosen to bear the expense of costuming and training the chorus as a public and religious duty. Attendance at the performances was an act of religious worship, and in the time of Pericles the state itself gave poor citizens the price of admission to the great open-air Theater of Dionysus (*see* Theater) that none might be debarred by poverty. All the greatest poets of the day competed for the prizes which were offered for the best plays.

The earliest of the three great Attic writers of tragedy was Aeschylus, who was born in 525 B.C. and was present at the battles of Marathon and Salamis. He wrote between 70 and 90 plays, of which 7 remain. Many of his dramas were arranged as "trilogies," that is, groups of three related plays. The 'Oresteia' (story of Orestes), consisting of the 'Agamemnon', 'Choëphori', and 'Eumenides', is the only trilogy that has survived from ancient times. The 'Persae' is a song of triumph for the defeat of the Persians. The 'Prometheus Bound' is a colossal rendering of the legend of the superhuman benefactor who stole fire from heaven for men (*see* Prometheus). For rugged power, sublimity of idea, and ethical grandeur Aeschylus stands without a peer.

For some 16 years, between 484 and 468, Aeschylus carried off prize after prize, but in 468 his place as the favorite poet of Athens was taken by a man some 30 years younger, Sophocles of Colonus (496–406 B.C.). Sophocles' long life covered practically the whole period of Athens' greatest glory. He won more than 20 victories at the Dionysia, and produced more than 100 plays, 7 of which are extant. Sophocles "saw life steadily, and saw it whole." This serenity of attitude together with the supreme skill with which his dramas were constructed, the beauty of his language and the nobility of his characters, give us a sense of majesty and harmony such as we find nowhere else in literature. He was the most Greek of all the Greek poets. His plays have been compared to the Parthenon for their power, self-restraint, and symmetry. The 'Antigone', which is perhaps the most celebrated drama in Greek literature, is typical of Sophocles' work. Its heroine is a model of womanly self-sacrifice, and underlying the whole tragedy is the sublime idea of a higher unseen law ruling the destinies of men. Others of his plays are 'Ajax', 'Oedipus Tyrannus', 'Electra', and 'Oedipus at Colonus'.

The third of the great tragic writers is Euripides (480–406 B.C.), who was born on the island of Salamis

—so the story goes—the day of the famous battle against the Persians. Although he presented his first play at 25, he did not take the prize until he was 39, and won it only five times in all in spite of his 92 produced plays. The reason for this is that he was a modern among the ancients. He questioned the popular idea of religion, and he drew real men and women instead of gods or demigods, or idealized human beings of heroic stature. For this reason Aristotle calls him "the most tragic" of the poets, for his plays, being the most human, were also the most moving. The conservatives of his own generation did not approve of him, but in later times he was exalted to a place with Aeschylus and Sophocles. His plays are more often performed on the modern stage than those of any other Greek poet. Eighteen plays have survived, including 'Alcestis', 'Medea', 'Hippolytus', the 'Trojan Women', 'Orestes', 'Electra', 'Iphigenia at Aulis', and the 'Bacchae'.

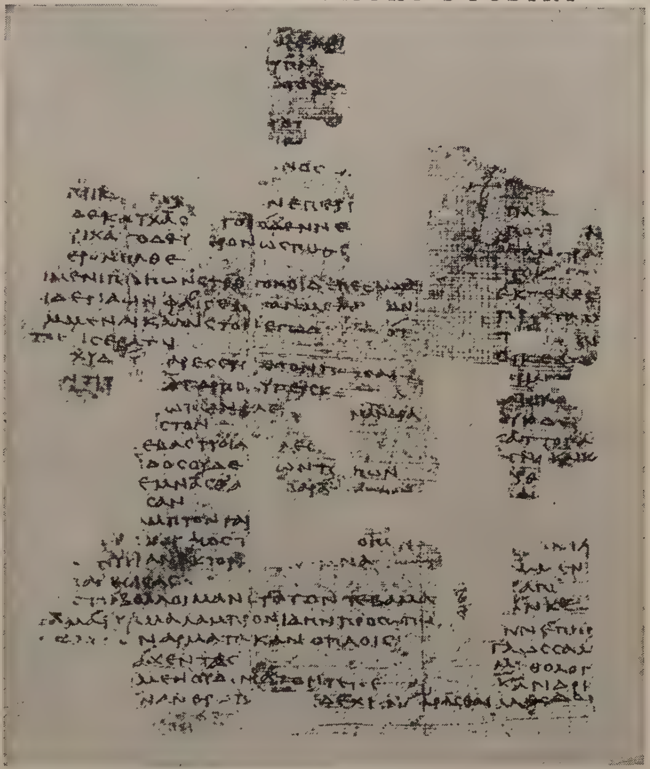
From Greek comedy only the plays of one man have survived—those of Aristophanes (about 448–385 B.C.), who was for 40 years "the great burlesque critic of Athenian life." His comedies are gay fun-making about the things of his own day, always from the standpoint of the conservative. He ridicules the new learning, in the person of Socrates, and savagely lashes Euripides, who stood for the inquiring innovating attitude that he particularly hated. Socialism, women's rights, the Peloponnesian War, the fondness of the poorer citizens for serving on juries now that Cleon had raised their pay to ten cents a day—these and other aspects of current Athenian life served as subjects for his stinging sarcasm and boisterous humor. Eleven of his plays survive, including the 'Knights', 'Clouds', 'Wasps', 'Frogs', 'Ecclesiazusae' (Women in Parliament), and 'Birds'.

As always in literary history, Greek prose was late in developing. In the 6th century some of the early philosophers formulated their ideas in brief sententious prose maxims, but the first truly literary use of prose is in the 'History' of Herodotus, written about the middle of the 5th century (*see* Herodotus). The theme of Herodotus is the struggle between East and West, culminating in the Persian Wars. His great successor Thucydides (about 471–396) told the story of the Peloponnesian Wars. Thucydides' critical use of sources, his inclusion of documents, his laborious research into the roots of events, make him the most modern of the Greek historians—"the first philosopher of history"—far removed from the romantic inclusiveness of Herodotus or of Xenophon (*see* Xenophon).

The 5th century also saw the rise of another prose art, the art of oratory, with its companion art of rhetoric, which taught the technique of making successful speeches. With the establishment of democracy in Athens and other Greek cities, the ability to make convincing speeches before the popular assemblies, and especially in the law courts, became of the greatest practical value. Litigants were usually compelled to plead their own cases, instead of hiring others to plead for them; so rhetoric became part of the ordinary education of the youth, and a new profession arose—that of the writer of speeches for men to speak in their own behalf. A large proportion of the speeches of the Attic orators that have come down to us were meant to be used in this way. The 4th century was the golden age of oratory, made memorable by the polished and artful speeches of Lysias, Isocrates, Aeschines, and the master orator of all time, Demosthenes (*see* Demosthenes).

The same lively curiosity and insatiable interest in the spectacle of the universe which led the Greeks to invent epic and lyric verse, drama and history, also made them the first philosophers. Their craving to find a reasoned answer to the riddles of life resulted in the creation of another department of prose literature, represented chiefly by the great names of Plato and Aristotle. Beginning with the 6th century, one thinker after another advanced his theory of the

A FRAGMENT OF SAPPHO'S POETRY



Very little of Sappho's poetry has come down to us. The character of her work is known largely through brief quotations from her poems found in the writings of other authors. Three fragments written on Egyptian papyri have been discovered in recent years, one of which is here reproduced.

material causes of the universe, of knowledge, and of conduct. Many of the fragments of their teachings which have been preserved in the form of terse epigrammatic statements in prose or verse seem crude and childish to us today, but they serve to remind us how long and toilsome is the road that leads to wisdom. (*See* Pythagoras.) The first thinker to lay a really scientific basis for philosophical inquiry was Socrates (469–399 B.C.), whose tireless questioning into the roots of conduct and searching criticism of all traditional doctrines so outraged the orthodox and narrow-minded that he was put to death (*see* Socrates). He wrote nothing himself, but his great pupil Plato (427–347) perpetuated and developed his teaching in a matchless series of dialogues, packed with fresh and stimulating ideas which have inspired every philosophical thinker since his day (*see* Plato). Third of the immortal trio of Athenian thinkers was Plato's pupil, Aristotle, the father of science. Aristotle sought to map out nearly the whole field of human knowledge into the various sciences, laying a foundation for all later scientific inquiry. In the history of literature, his work cannot rank with the superbly artistic Platonic dialogues, but in the history of thought he is acknowledged as "the master of those who know." (*See* Aristotle.) Theophrastus, who succeeded Aristotle as head of the school called the Lyceum, is chiefly remembered for a series of lively character sketches which have found imitators in every age.

With these names the story of classical Greek literature ends, but the Hellenistic age in Alexandria offers us a second rich library (*see* Alexandria, Egypt). The name that stands out in poetry is that of Theocritus, who wrote exquisite little shepherd dialogues picturing the rural life of his native Sicily. Imitators from Vergil to our own day have tried in vain to recapture the freshness and charm of the pastoral form as Theocritus first used it. Other poets of this age are the lyric poet Callimachus; Bion and Moschus, writers of pastoral verse; and Apollonius Rhodius who wrote the Argonautica, an epic in four books on the quest of the Golden Fleece. Greek prose, too, continued to flourish far into Roman times, and from these later days we have our first forerunners of the novels (*see* Novel), as well as important works of geography and history.

The most noteworthy of these later writers are the historians Polybius, Diodorus Siculus, Josephus, and Appian; the geographers Strabo and Pausanias; the biographer Plutarch, who has given us more general information about antiquity than any other single writer (*see* Plutarch); the critic Longinus, to whom is assigned one of the best of all works of literary criticism, the treatise 'On the Sublime'; the humorist Lucian, whose 'Dialogues of the Gods' are almost as outrageously laughable as a comedy of Aristophanes; and the two Stoic philosophers Epictetus and Marcus Aurelius, one a slave and the other an emperor (*see* Epictetus; Marcus Aurelius Antoninus).

In various localities the Greek language was spoken and written with variations sufficiently great to cause three chief dialects to be recognized, though the differences were never so great as to cause difficulty of communication. The Ionic dialect, the language of Homer and Hesiod, was spoken in most of the Aegean islands and on the west coast of Asia Minor. With a few modifications, the Ionic is identical with the Attic, the principal literary dialect, used in the works of the great Attic writers. The Doric, the language of Pindar and Theocritus, was spoken at Corinth and throughout most of the Peloponnesus. The Aeolic, in which Sappho wrote, was spoken in Boeotia, Thessaly, and Aeolis (northern Asia Minor).

In modern Greece there is a sharp cleavage between the dialect of the people, called "Romaic," and the literary language, which represents an attempt to return so far as possible to the standards of classical Greek. The struggle between the "purists" and the adherents of the popular tongue is still waged with so great bitterness that in 1901, 20 persons were killed or injured in a mass meeting of protest against the proposed issue of a translation of the Gospel into Romaic. The style of most current literature and journalism represents a compromise between these two ideals, but the most powerful poetry and fiction are written in the "vulgar" tongue.

GREELEY, HORACE (1811–1872). If it is true that "the pen is mightier than the sword," then Horace Greeley, the newspaper man, might possibly be considered greater than Grant and Lee or any other general of the Civil War. Not only was he the greatest molder of public opinion in the period preceding and during the war, but he was probably the greatest journalist America has ever produced. Because of the importance of his work the poet Whittier called him "our later Franklin."

Greeley was, in his own words, "born in poverty, cradled in obscurity, and early called from school to rugged labor," but he sought "to convert obstacles into opportunity, and wrest achievement from difficulty," and his efforts were successful.

Born in New Hampshire, he learned the printing trade in Vermont, and later joined his parents in western Pennsylvania. In 1831 he went to New York with $10 in his pocket and his clothes in a bundle carried over his shoulder. After several newspaper ventures which brought him much notoriety but little money, he started the *New York Tribune*, as a Whig daily, in 1841.

The success of this paper was immediate, and its circulation soon covered the country from the Atlantic to the frontier of Missouri. In its columns Greeley opposed slavery, advocated a high protective tariff, and aided the temperance movement. At the outbreak of the Civil War he urged the government to refrain from "pinning one section to another by bayonets." Afterwards he was an earnest upholder of the government, and he urged the emancipation of the slaves even before Lincoln was ready for that step.

After the war was over Greeley wished the country to treat the South leniently. To set an example, he signed the bond by which Jefferson Davis was given his freedom. He could not carry the country with him in this attitude, however; and in 1872, when he was the candidate of the Liberal Republicans and the Democrats against Grant, he was disastrously defeated. Borne down by political and domestic misfortune, he fell ill, and died Nov. 29, 1872.

In spite of the success of the *Tribune* and the large sum Greeley made on the lecture platform, he was never wealthy, because he always aided everyone who asked him for help, both the worthy and the unworthy. He was extremely simple in his habits and careless in his dress. His handwriting was so poor that it was the despair of type-setters on the newspapers, who declared that it resembled nothing so much as the muddy tracks a hen would make walking over a piece of white paper. For brilliancy of mind and high moral courage, he was unsurpassed among the men of his day.

GREENE, NATHANAEL (1742–1786). By common consent the brilliant general Nathanael Greene is regarded as a military leader second to Washington alone in the American Revolution. His father was a blacksmith in Potowomut, R.I., but a Quaker preacher on Sundays, and trained his son in the strict principles of that sect. When the quarrel between the colonies and England was growing hot, Greene joined the militia, and studied military tactics. For this martial zeal he was excommunicated by the Friends' Church. His military training won him a brigadier-generalship and the command of the Rhode Island forces in 1775. He marched his troops to Cambridge after the skirmishes at Lexington and Concord and welcomed Washington as the new commander-in-chief in July 1775.

Greene speedily won the friendship and confidence of Washington, under whom he served with distinction at Trenton, Princeton, and Brandywine. At Washington's request he accepted at Valley Forge, in March 1778, the difficult position of quartermaster-general, retaining, however, the right to command troops in the field. Because of the meddling of Congress with the affairs of his department Greene resigned his position in 1780, but was shortly afterwards appointed by Washington as commander of the Army of the South.

When Greene succeeded Gates in this command, he found the army in so wretched a state, without discipline, arms, or clothing, that he could not bring it into condition for fighting until 1781. As soon as this had been accomplished, he began a campaign which in less than a year stripped the English of all their conquests in the Carolinas and Georgia except Charleston, in which he penned up the British army for the rest of the war. For this he received the thanks of Congress, large grants of land from the Carolinas and Georgia, and the name of "the man who saved the South" in the American Revolution.

CHILDREN OF THE LAND OF SNOW

Whatever other people think of the climate of Greenland, it is easy to see that it just suits little Shoo-e-ging-wah and Megipsoo.

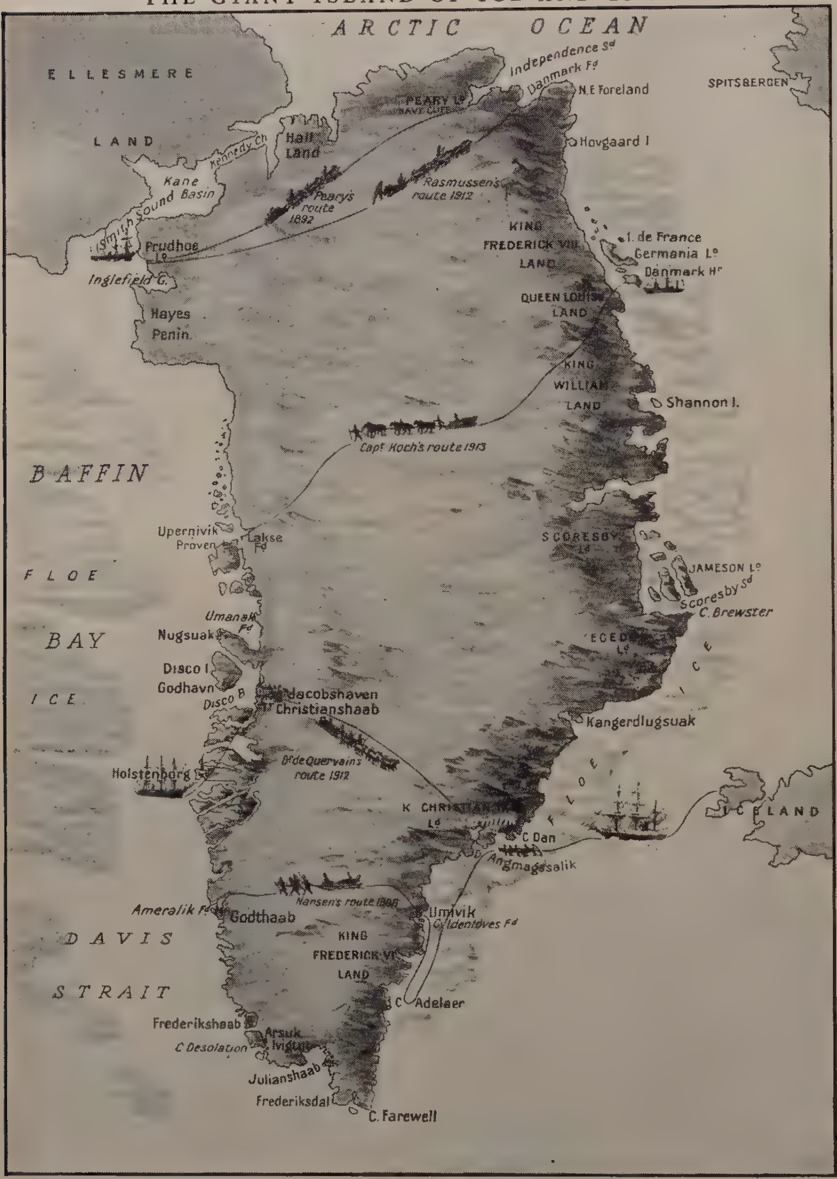
GREENLAND FASHIONS

Here we see a Greenland belle dressed in her finest party clothes.

GREENLAND. The snows of countless centuries have woven an impenetrable winding-sheet of ice thousands of feet deep over more than three-fourths of the surface of this immense continental island, which lies to the northeast of America and almost wholly within the Arctic Circle. Its narrow rocky shores are fringed with ancient worn-down mountains (some more than 10,000 feet high) and deeply cut by innumerable fiords and valleys. Only a few hardy explorers have crossed the ice-capped interior, so its topography is imperfectly known. It is certain, however, that it is the largest island in the world, estimates of its area ranging from 512,000 square miles to 825,000, while New Guinea, the second largest island, has only about 300,000 square miles. Greenland's length is about 1,600 miles and its breadth from 800 to 900 miles.

Denmark exercises authority over the entire island, but only 46,740 square miles are under settled government. The east coast is uninhabitable because of a cold current, but the west coast is warm enough to permit the growth of a narrow belt of green tundra. Life in this arctic wilderness is a simple isolated one for its inhabitants, the hardy Eskimo and the few hundred Danes and half-breeds, who live with their dog-sledges and *kayaks* (sealskin covered boats) in the stone or snow-hut settlements along the coast. In the uncertain climate of fogs and snows and icy winds

THE GIANT ISLAND OF ICE AND SNOW



The man who named Greenland must have had a fine sense of humor. The west coast, to be sure, has a narrow belt of green, and no doubt was looking particularly attractive to Eric the Red when he landed there back in the 10th century. But for the most part its surface is just one enormous glacier. We see here the course of bold explorers who have crossed this vast region, where the temperature sometimes reaches 90° below zero.

(bitterly cold in the sunless north, but down in the southwest often mild enough to breed mosquitoes), these people live an out-of-door life hunting seals, whales, walrus, bear, or fox, and fishing for salmon, cod, and halibut. Their commerce is a Danish monopoly and their trade is carried on chiefly by the barter of their principal exports—whale and seal oil, eiderdown, and skins. They also mine and export cryolite in large quantities. This is a light brilliant mineral used in making soap, soda salts, aluminum, and a fine quality of glass, and the mining rights are held by Americans under a Danish charter. Coal, copper, and iron have also been discovered. A considerable native literature has been published, including a periodical written and illustrated by Eskimos.

From "Greenland's icy mountains" comes the dangerous glacier sheet that flows under pressure of its own weight, discharging into the sea every year more than 1,000,000,000 tons of ice (*see* Glacier). Many of these glittering icebergs are carried down into the lanes of ocean travel, where they imperil navigation (*see* Icebergs). It has been estimated that if all Greenland's ice were spread over the United States it would make a covering a quarter of a mile thick!

Greenland was named by the Norwegian Eric the Red, who about the end of the 10th century reached its southwestern coast and founded a colony. Communication with Norway ceased in 1410 and Greenland became lost to the world until the close of the 16th century, when it was rediscovered by English explorers in search of the Northwest Passage to India. In recent years Greenland has been a favorite field for explorers. Americans from Kane to Peary have discovered, explored, and given names to nearly all its north and northwestern shores, and it has been an important stepping stone for polar exploration in the remoter north. Population, about 14,000. (*See* Eskimos.)

GREGORY, POPES. Sixteen popes—two of them among the greatest the church has produced—have borne this honored name.

GREGORY I, called the Great (lived about 540–604), was a Roman of old family and great wealth who became a monk in a Roman monastery which he himself endowed. His interest in the Roman island of Britain was aroused by seeing some beautiful English boys sold as slaves in the market place at Rome, and when he became pope in 590, he sent St. Augustine as missionary to England to convert the people from their heathenism. Gregory defended Rome against repeated attacks of the Lombards and exercised much of the power in the West which had fallen from the hands of the weak Eastern emperors. He also wrote ably on theology and composed the Gregorian chant which is still used in church services. He was one of the ablest of the popes, and after his death was made a saint.

Gregory VI (died 1047) earned a high reputation for learning and uprightness, but he was deposed by a council held by Emperor Henry III, on the ground that in a time of confusion he had obtained his office by improper means.

Gregory VII was the mighty Hildebrand (lived 1020–1085). After being the power behind the throne for a quarter of a century, under five popes, he himself was chosen pope in 1073. His pontificate is memorable for the beginning of the great Investiture Conflict with the Emperor Henry IV of Germany. His purpose was to create a sort of "league of nations" with the Pope as its head. A Catholic historian sums up Hildebrand's ideas in these words: "Seeing the world sunk in wickedness and threatened with impending ruin, and believing that the Pope alone could save it, he conceived the vast design of a universal theocracy, which should embrace every kingdom of Christendom, and of whose policy the Ten Commandments should be the fundamental principle. Over this commonwealth of nations the Pope was to preside. The spiritual power was to stand related to the temporal as the sun to the moon, imparting light and strength, without, however, destroying it or depriving princes of their sovereignty."

After a violent conflict Henry IV was obliged to humble himself, barefoot and fasting, before the Pope at Canossa (1077). But the struggle soon recommenced. Henry attacked the Pope in Rome itself; and the aid of the Norman Robert Guiscard only permitted Gregory to retire from Rome to Naples. He died at Salerno shortly after, saying: "I have loved justice and hated iniquity; therefore, I die in exile." No pope ever left a stronger impress on his time than did the fearless, upright, inflexible Gregory VII.

Gregory IX (pope 1227–1241) is chiefly memorable for his conflict with the Emperor Frederick II. **Gregory** XI (pope 1370–1378) was a French churchman who instituted many reforms and transferred the papacy back to Rome from Avignon, where it had been for 70 years. **Gregory** XII (pope 1406–1415) upheld the rights of the Roman pontiffs against the Avignonese antipope Benedict XIII, in the time of the Great Schism. **Gregory** XIII (pope 1572–1585) made the great reform in the calendar. **Gregory** XVI (pope 1831–1846) encouraged learning and founded the Egyptian and Etruscan museums in the Vatican.

Grenfell, Wilfred Thomason (born 1865). For generations to come, one of the favorite stories of the Labrador fisher folk will tell how this doctor brought comfort and joy and health to their desolate land, for Wilfred Grenfell is an English medical missionary who has earned renown for his self-sacrificing labors on behalf of sailors in the North Sea and the inhabitants of Labrador.

Upon his graduation from Oxford University he entered London Hospital to study medicine and surgery. He had decided to devote his life to missionary work, and he had the idea that practical help in bettering health and living conditions should go hand in hand with religious teachings. Among his patients were many seamen, for the hospital was in the Whitechapel district, a region notorious for its poverty and crime. Becoming interested in this neglected class of men, most of whom had no permanent home, he fitted up an old sailing vessel for a mission ship, and went out into the North Sea, among the tramp steamers and fishing fleets. Within a few years he built a sailor's hospital, a coöperative store, a mill, an orphanage, and a school. He attracted so much attention by his brilliant success in this unique work that Lord Strathcona, the railroad and empire builder of Canada, gave him a steel steamer to carry it further.

WILFRED GRENFELL
The Doctor Missionary

From Lord Strathcona, who in his youth had been a fur buyer in the Canadian wilderness for the Hudson's Bay Company, Dr. Grenfell heard of the deplorable condition of the English, Scotch, and French-Canadian fisherfolk of Labrador. During the short summer, ministers and doctors from Newfoundland visited the fishing villages along the 3,000 miles of that wild coast; but for nine dark months of every year the people were frozen in, with no means of communication with the outside world except by dog-sledge over the treacherous ice.

In 1892, when he was 27 years old, Dr. Grenfell went to Labrador, and made that forbidding region the field of his missionary labors. Every summer since, although icebergs and floes, fogs, gales, and jutting crags make his voyages dangerous, he has cruised up and down the coast in a swift steam yacht, stopping in any harbor where a signal flag flies. In winter he travels by dog- or reindeer-sledge. He has fought epidemics of smallpox, made the villages sanitary, instructed the women in nursing, and taken the seriously ill and injured to his hospitals in Battle and Indian Harbors. He has opened a road along the coast and introduced reindeer herds for their milk and for rapid travel. He preaches on Sunday in any schoolhouse, christens the babies, marries the young, and buries the dead. His traveling library circulates books, papers, and magazines, and he has brought Santa Claus to the children.

Finding that Christmas was not being properly kept in this bleak and remote corner of the world, Dr. Grenfell made a public appeal for gifts. Great boxes arrive in Battle Harbor in the summer, and at Christmas there is a decorated tree in every village church, and a Santa Claus who dashes up in a gay red cutter, with prancing reindeer. In all the world there is not a more beautiful or helpful mission than that of this doctor-knight of Labrador.

Dr. Grenfell is the author of the following books related to his work: 'Off the Rocks' (1906); 'Adrift on an Icepan' (1909); 'Labrador, The Country and Its People' (1909). Norman Duncan, who knows him and his work intimately, has written 'Dr. Grenfell and his Parish' and two volumes of fiction based on his devoted service and heroic experiences.

GREY, LADY JANE (1537–1554). This sweet-souled and innocent child, the "nine-days' queen" of English history, was sacrificed to the self-seeking ambition of shameless intriguers. By the will of her great-uncle, Henry VIII, she had been placed next after his daughters Mary and Elizabeth in the line of succession to the throne. It was thought possible to discredit Mary and Elizabeth as illegitimate, and thus make Lady Jane heir to the throne after the sickly Edward VI. With this purpose in mind the unscrupulous Duke of Northumberland caused her to be married to his son Guildford Dudley; by this means he hoped to continue himself in power after Edward's death. Edward died on July 6, 1553. Lady Jane was proclaimed queen on the 10th. By the 19th the whole scheme had collapsed, Northumberland was arrested, and she too was a prisoner.

Lady Jane was never to be free again. She remained locked in the gloomy Tower of London for many months. Then an uprising against Queen Mary, in which Lady Jane's father took part, led the queen to seal Lady Jane's death warrant. She was beheaded on Tower Hill, London, on Feb. 12, 1554. In her speech from the scaffold she "washed her hands" of any desire to be queen, and said: "I die a true Christian woman." The place of her imprisonment still draws to it the feet of later generations, whose hearts have never ceased to sorrow over the hard fate of this beautiful and innocent girl.

GRIEG (*grēg*), **EDVARD HAGERUP** (1843–1907). The peculiar leaping rhythms and strange harmonies of Scandinavian folk-music were the inspiration that brought Grieg to a position among the great composers of the 19th century. He was born in Bergen, Norway, but was sent to Leipzig, Germany, for his musical education, and his early compositions give evidence of this German influence. But on his return to Norway his imagination was seized by the entrancing Norwegian folk-songs and he determined to develop the full beauty of these artless tunes by making them the basis of compositions for piano and orchestra. Thus he did for Norway what Chopin did for Poland, and Liszt for Hungary.

When Grieg was 31 years of age the Norwegian government granted him a life pension. Thus relieved from the necessity of teaching, he devoted himself entirely to composition, with occasional concert tours. As a conductor he was magnetic, and everywhere he was acclaimed as a most individual and enchanting pianist. He played only his own compositions—beautiful lyrics, tone-poems for the piano, that breathe all the exhilaration and freshness of the northland. Of his orchestral works the frequently heard 'Peer Gynt' suites are most popular. His 125 songs are hauntingly distinctive with great depth of feeling and originality in melodic and harmonic structure. The last years of Grieg's life were spent in his beautiful villa Troldhaugen, near Bergen, Norway.

GROSBEAK. "Fine feathers do not make fine birds," but often extremely fine birds have fine feathers. The rose-breasted grosbeak has beautiful black-and-white plumage with a rose-colored breast, a lovely song, a happy manner, and a clear conscience, for he knows that the few green peas and berries in his crop have been paid for many times over (for illustration in colors *see* Birds). Even though he lacked beauty, song, and manners, his appetite alone would make him invaluable to the gardener, for with his plainly feathered mate and his hungry brood he will rid a bug-infested potato patch of the pests in short order and supplement the potato-bug diet with such caterpillars as army-, canker-, and cutworms. Does he not deserve a few berries and peas?

THE SPARROW MEETS HIS MATCH

The Sparrow has earned a bad reputation by driving away so many of our song birds, but he soon learns to let the Grosbeak severely alone. Here a Grosbeak is driving a Sparrow away from a feeding log.

Quite as much can be said in favor of other grosbeaks, which is a common name for a group of the finch family with thick powerful beaks (hence the name grosbeak). All have bright-colored feathers, lovely songs, and appetites for harmful insects. The rose-breasted grosbeak is commonly spoken of as *the* grosbeak, but other species such as the pine and evening grosbeak equally deserve the name. They are from 8¼ to 9 inches long. The females of all species are quietly colored. The feeding and nesting habits are similar, except in the case of the pine grosbeak which eats no insects and feeds almost entirely on seeds of such trees as the pine, ash, and sumac. The nest of twigs and weed-stalks is built in trees. The spotted eggs are from three to five in number. The birds migrate south in winter, though the evening and the pine grosbeaks are found wintering as far north as Iowa, Illinois, and New England.

The cardinal is the most showy of the group (*see* Cardinal Bird). The home of the rose-breasted grosbeak is in the eastern half of the United States and southern parts of Canada. It winters south to Cuba and Central America. The evening grosbeak with its striking yellow and black feathers is found in Canada and occasionally during the winter flocks have been seen in the northeastern United States. The black-headed grosbeak of the Far West and Mexico has a neck and breast of tawny gold and his black wings marked with white (for illustration in colors *see* Birds). It is said that the female of this species, contrary to all mother-bird rules of caution, sings while on her nest. The blue grosbeak, a rather rare bird of the southern United States, has dark blue-gray feathers. The pine grosbeak is found in the pine-tree regions of both the Old and the New World. Its beautiful reddish-pink feathers which blend so beautifully into the gray under-plumage change, after molting, to yellow. Another common grosbeak of Europe is the hawfinch. It has a crown and back of rusty brown, gray under parts and black and white wings.

GROUNDHOGS IN CLOVER

During the warm weather, the Groundhog spends most of his time in the open fields eating for all he is worth. For he does not lay by a winter supply of food, and must rely instead on the surplus fat he accumulates under his skin to keep him alive during the "sleeping season." Here we see a whole family chewing up a clover field and gaining weight with each mouthful.

Grosbeaks belong to the family *Fringillidae*. Scientific name of rose-breasted grosbeak, *Zamelodia ludoviciana*.

GROUNDHOG. The groundhog, also called the woodchuck, is America's most famous, though not most accurate, weather prophet. Tradition insists that on February 2 of each year—"Groundhog Day"—this little animal, which has been snugly curled up in its burrow all winter, sleepily living on its own fat, emerges for a look about to see if it is time to resume its waking life. If the sun is shining so that it can see its shadow, it retires for another six weeks of slumber in its subterranean home, according to the popular legend, but if the sky is cloudy, it remains outside, anticipating an early spring.

Groundhogs are well known in the eastern states and in Canada. They like grassy hillsides and wood-pastures, especially if there is wooded country near that offers a safe retreat. Their homes are usually in the midst of a forest where their burrows are quite elaborate affairs of branching galleries. They feed on clover and succulent grasses including various cultivated crops, especially the vegetables in fields and gardens, and hence are regarded as a nuisance. They have practically no economic value. Their flesh is little esteemed and their pelts of coarse hair are worthless as fur. They do not store up food in the summer, but as the winter draws near they feed heavily and become excessively fat and when winter has come retire to their burrows and sleep until spring. Their surplus flesh is used up during this period, so that they emerge looking very thin indeed.

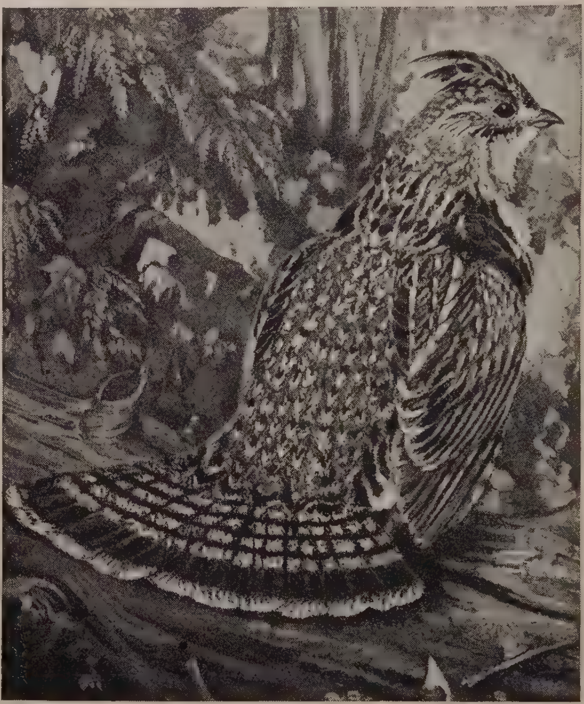
The groundhog or woodchuck (*Arctomys monax*) is a typical marmot, with coarse hair, heavy body, short bushy tail, and powerful legs and feet armed with strong claws. When fully grown it weighs about ten pounds. The color varies from brownish gray to almost black. When alarmed it utters a curious shrill whistle of fear.

GROUSE. The grouse is the sportsman's favorite bird, and the eagerness with which it has been hunted has almost exterminated it in some regions where it was once very abundant. Most of the 25 species found in the Northern Hemisphere are excellent eating and no less excellent sport for the hunter. It is the

Here's a Grouse's nest, snugly tucked away among the leaves and brush in the woods, and there are one, two, three — fourteen eggs! What large families those Grouse people have!

habit of these dull-plumaged birds to lie hidden in the grass until the dogs are upon them; then, with a sudden great whirring sound, and with almost the speed of an arrow, they rise before the eyes of the startled hunter, who must be both cool and quick if he is to bag his game.

WHEN MR. GROUSE GOES COURTING



Here Mr. Grouse has taken his position on a log, and the flutter of his wings is producing that "drumming" sound that is heard a mile away. That sound is his love song.

The common colors in the plumage are brown, gray, and red, with touches of purple and dark green in some species. Generally the colors of the male birds are more pronounced. The dress of the female is an excellent example of what naturalists call "protective coloration" (*see* Protective Coloration). It is so nearly the color of her surroundings that, if she remains motionless on her nest among the grass and leaves, even a keen-eyed fox or hawk will pass her by. Some members of the grouse family that live in regions where snow is common change their sober summer coats for a winter plumage as white as the snowy wastes they inhabit, and grow downy feathers on their feet that keep them from sinking into the snow. Other species grow horny appendages from the sides of the toes to serve as their snowshoes.

"SNOW GROUSE" IN THEIR WINTER CLOTHES

This is a scene in the far North, and the Ptarmigans or "Snow Grouse" have changed their summer coats of grayish brown to their winter clothes of white.

The male birds are noisy wooers. During the mating season their peculiar love-calls may be heard ringing through the woods and over the prairie lands. These calls, which take the place of the mating song of singing birds, are dull booming sounds variously produced. Some species have a most extraordinary wing power and by rapidly beating the air or their breast feathers produce a sound that may be heard a mile or more. Other species are furnished with an air sac of loose skin which acts as a sort of bagpipe, for the bird inflates it to an amazing size; then, with a jerking of the head, he forces the air from it with a hollow "boom, boom, boom," which draws the female birds of their kind. These love "songs" are accompanied by much strutting about and spreading of feathers, and by many fights among the cocks.

Grouse range in size from the small white-tailed ptarmigan 13 inches long to the sage hen 30 inches long. They eat seeds, fruits, and insects. Among all the various species, except the ptarmigans, one cock mates with a whole covey of hens. The nest is on the ground and the hen takes entire care of the 10 to 14 eggs and of the young brood.

Of the North American species the best-known is the ruffed grouse, incorrectly known in the North as the "partridge" and in the South as the "pheasant." It is found throughout southern Canada and eastern United States, west to eastern Kansas and south to northern Georgia. It is about 18 inches long and has tufts of shiny black feathers on each side of its neck, which look like a ruff and so give the bird its name. A crest of feathers adorns the top of its head. In the early days before this bird had come to know the ways of man it was so trustful and unsuspicious that it would sometimes sit quietly gazing at the traveler until it was knocked from its perch with a club. Hence the ruffed grouse, as well as other varieties showing the same tendency, came to be spoken of as "fool-hens." But once having learned the lesson of the dog and gun, the grouse became wise to an almost uncanny degree. Hunters tell of seeing a mother bird try to entice them away from her brood by crying and fluttering along the ground as if wounded; and when attacked she will defend the young with her life.

The prairie chicken (pinnated grouse) is a favorite species found in central Canada and in the central United States, though in sadly reduced numbers. It weighs about two pounds and is one of the finest wild food-birds. There is a slight crest on the head and long tufts of narrow stiff feathers grow backwards on each side of the neck. The male birds have a calling air-sac on each side, just under the neck tuft of feathers.

The sage hen is the largest of the family, coming next to the turkey in size. Its home is the barren alkali deserts, where it lives almost entirely on sage bush leaves. This gives the old birds so strong a sage flavor that they are not desirable for the table, but the young are good eating, and have been so much hunted that the species is fast being exterminated.

The ptarmigans, sometimes called "snow grouse," are smaller birds of the grouse family. They live in the arctic region of America, from Alaska to Labrador, but sometimes migrate for breeding to the northern states. In the autumn they change their summer coat of grayish brown to a winter coat of pure white. Explorers and the Indians and trappers of the North have found them a valuable food supply.

The red grouse or moorfowl is the famous grouse of the British Isles. It is so well protected by law that it is very plentiful, and sportsmen from all over the world go to Scotland every fall for the grouse-shooting.

The grouse belong to the order *Gallinae*, which also includes the common hen and quails, turkeys, and pheasants. Scientific name of ruffed grouse, *Bonasa umbellus;* prairie chicken, *Tympanuchus americanus;* sage hen, *Centrocercus urophasianus.*

GUADELOUPE (*ḡạ-dĕ-lo̤p′*). About 75 miles north of Martinique, in the French West Indies, lie the twin islands of Guadeloupe, which with five nearby islets constitute the largest colony of the French in this region (area, 688 square miles). A narrow strait divides the two main islands, one of which is crowned by lofty mountains, while the other is a low plain. The products are chiefly sugar, coffee, vanilla, cocoa, and rum. Terrible damage is often done by earthquakes and by the terrible hurricanes which sweep the Caribbean Sea. The capital is Basse-Terre (9,000 inhabitants), but Pointe-à-Pitre (23,000 inhabitants) is the chief town and harbor.

Guadeloupe was discovered by Columbus in 1493. Except for three short intervals when it was held by the British, it has been French since 1634. It is administered by a governor and general council, and is represented in the French Parliament by a senator and two deputies. Population, about 215,000, chiefly negroes and mulattoes.

GUAM (*ḡwäm*). The first of the South Sea Islands to feel the touch of a white man's foot was Guam, now the possession of the United States; for Ferdinand Magellan landed on Guam, the southernmost of the Marianas group, on March 6, 1521. When the natives stole one of his small boats, Magellan burned the houses along the beach and killed eight of the inhabitants. Guam and the neighboring isles were called the "Ladrones" or "Thieves Islands" by Magellan's crew; but later the name was changed to the Marianas.

The importance of Guam today is due to the fact that it is a United States naval station, one of the landing-places of the submarine cable running from San Francisco to Manila in the Philippines, and a wireless telegraph station. Guam, together with the other islands of the Marianas group, was seized by the United States during the Spanish-American War in 1898. After the war Spain was allowed to keep the neighboring islands, and in 1899 sold them to Germany; with the downfall of Germany in the World War they passed to Japan under a mandate from the League of Nations.

Guam is about 32 miles long and from 4 to 10 miles wide. Most of the island is a pathless jungle, inhabited by native rats, flying foxes, and bats, and by imported deer, wild goats, and wild pigs. European cattle and water buffaloes are the principal domestic animals. The island produces rice, sugar, tobacco, hemp, coffee, cocoa, bananas, sweet potatoes, melons, and valuable timber. The coconuts are the finest in the world. The climate is mild, but typhoons frequently sweep the island and do great damage.

Agana, a thoroughly modern city of 8,000 inhabitants, is the capital, and San Luis de Apra is the principal port. The commandant of the naval station is also governor of the island; he is appointed by the president of the United States. There are few pure-blooded members of the original Malay inhabitants left, the natives being of mixed Filipino, Malay, Japanese, Chinese, and Spanish blood. Population, about 14,000.

GUATEMALA (*ḡwä-tē-mä′lä*), REPUBLIC OF. So abundantly has nature bestowed her gifts upon Guatemala, the most populous and by far the most important state of Central America, lying just south of Mexico, that the natives are wont to refer to it as "Paraíso," or "Paradise." With an area of 48,290 square miles, making it smaller than North Carolina, Guatemala includes a remarkable variety of scenery and climates.

You may travel from coast to coast on the inter-oceanic railroad, starting at sea-level in the early morning from Puerto Barrios on the Atlantic coast. You pass through richly foliaged banana lands, with the little towns that have sprung up to care for the workers, and then through many miles of uncultivated country with an endless variety of tropical vegetation. Here and there you may see the quetzal, the national bird of Guatemala, with its brilliant and sparkling feathers, and millions of other birds of gay plumage. As you gradually ascend by a series of plateaus and terraced slopes the climate becomes more agreeable and healthful. In the great interior tableland, 5,000 feet or more above sea-level, perpetual spring prevails, with rains from April to October.

After crossing the lofty mountain backbone (10,000 to 12,000 feet), which runs within 50 miles of the Pacific coast, you arrive at Guatemala City (population, 90,000), the thrice-destroyed capital of the republic. After the terrible earthquakes and volcanic eruptions of 1541 and 1773, the people built the present city on a site which seemed safe from earthquakes, since the great cathedral, erected by the Spaniards in 1620, had stood for 150 years. Here for a century and a half "New Guatemala" throve, until the dreadful convulsion of 1917, when even the great church was shattered, and the little bright-colored adobe houses that used to glisten in the brilliant sunlight, together with the more pretentious dwellings, were all destroyed. Its loyal citizens at once set about rebuilding upon the same site, not wishing to abandon a railroad and commercial center so favorably situated upon the great divide between the Atlantic and Pacific.

From the capital you entrain for San José, the Pacific port, and get a glimpse of the richest and most densely settled lands of the republic. Although Guatemala is rich in gold, silver, lead, and other minerals and has immense forests of valuable timber (the Indian name Guatemala is said to mean "Land of Forest"), its chief industry is agriculture. Abundant rainfall and the fertile volcanic soil make possible two crops of wheat a year, three crops of corn, and rich yields of very fine coffee, of which nearly 100,000,000 pounds are exported annually. You pass plantations (more than half under German ownership) where hundreds of workers are picking coffee beans or working in the fields of sugar cane before you reach the little port of San José. Here you enjoy the excitement of being let down from the dock in a cagelike basket into a lighter below, for ocean vessels are not able to enter San José.

Pure Indians comprise fully 60 per cent of the people; of the remainder, classed as "Ladinos," or Latins, a large majority are half-castes and a smaller proportion pure whites. Population, about 2,000,000. (*See* Central America.)

GUELFS (*ḡwĕlfs*) AND **GHIBELLINES** (*ḡĭb'ĕ-lĭns*). The rivalries of these two great political parties long distracted Germany and Italy. "Welf" (which became "Guelf" in Italian) was the name of a German ducal family which ruled Bavaria and Saxony in the Middle Ages, its most noted member being Henry the Lion (1129–1195), who was deprived of his duchies by the Hohenstaufen emperor Frederick I (Barbarossa). The rival battle-cries of these two families—"Hi, Welfen!" and "Hi, Waiblingen!" (the latter from a little village in Swabia near Castle Hohenstaufen)—were corrupted in Italy into "Guelf" and "Ghibelline," respectively. The Hohenstaufens stood for a strong monarchial government and for the imperial rule over Italy, while the Welfs represented feudal opposition to the monarchy and the independence of the Italian towns. The influence of the papacy was usually on the side of the Guelfs. After the fall of the Hohenstaufen emperors (1254), the larger issues between the two parties were lost sight of in petty feuds. By the 15th century the names Guelf and Ghibelline lingered only in Italy, where they came to mean little more than differences in the wearing of feathers in the cap, in cutting fruit at the table, in gestures in speaking or swearing, and the like.

The house of Welf (Guelf) continued to rule certain parts of Germany—Hanover and Brunswick—until late in the 19th century. With George I, in 1714, the Guelf (or Guelph) family came to the throne of Great Britain.

GUIANA (*ḡē-ä'nạ*). That little known part of South America which lies between the Orinoco River, the Amazon River and its tributary the Rio Negro, and the Atlantic Ocean, is known to geographers as Guiana. In common usage, however, Guiana means especially the three colonies of British Guiana, Dutch Guiana, and French Guiana.

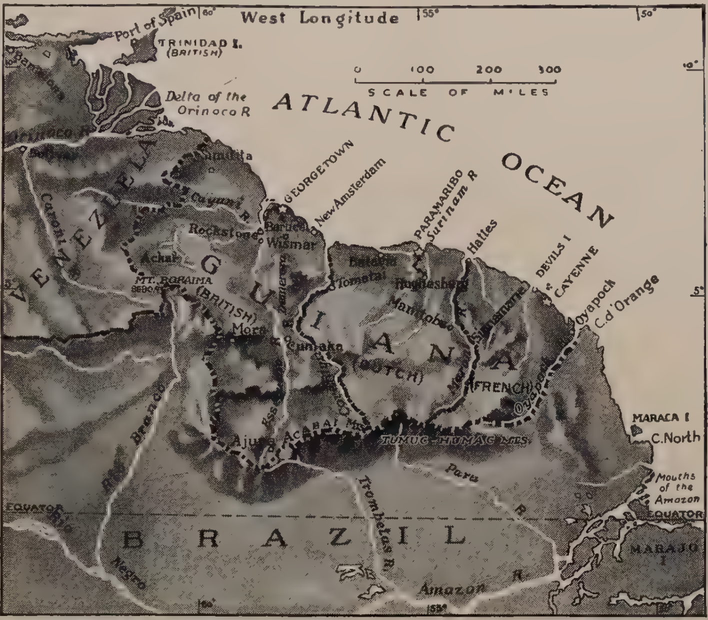
The coast is everywhere low, hardly rising above high water mark. For 20 miles inland the land was once a mangrove swamp, but it was diked and drained by the early settlers and thus made into fertile plantations. Along the shores and on the banks of the numerous rivers, where similar plantations have been formed, live the scanty population. Beyond the stretches of rich heavy loam brought down by the rivers, lie low ridges of sand and shells, showing where the coast line was in former ages. Farther inland the country rises into a rocky hilly plateau (3,000 to 4,000 feet above sea-level), covered with primeval and almost impenetrable forests, except where grassy plains or *savannas* occur. The ranges of low mountains and hills which traverse this plateau are rich in gold, aluminum ore, and other minerals.

Luxuriant Life of the Forests

In the perpetual summer of the hot moist climate vegetation flourishes. The district is noted for the height and variety of its trees, many of them furnishing valuable woods; and for the size of the leaves and flowers. Orchids sometimes grow in large masses with flower-stems 12 feet high, and gigantic vines festoon the trees. In the lagoons and rivers grow many kinds of water-lilies; the largest, the famous *Victoria regia* with leaves five or six feet across, was brought from British Guiana and distributed over the civilized world. Alligators and great fish of innumerable species abound in the rivers, and the forests are filled with richly-plumaged birds, such as the scarlet ibis, white egret, and flamingo; reptiles, and such wild animals as the tapir, sloth, ant-eater, jaguar, and monkey. The insects are remarkable for the great number of varieties represented and for the brilliance of their coloring.

The Guiana coast was first sighted on the third voyage of Columbus in 1498. During the 16th century many Spanish and Portuguese adventurers made unsuccessful visits to its rivers in search of the fabled El Dorado. Sir Walter Raleigh led several expeditions and was beheaded soon after his last disastrous voyage. By the middle of the 17th century several British, Dutch, and French settlements had been founded. The colony of Surinam, now known as Dutch Guiana, was given up in 1667 by the British to the Dutch in return for the surrender of their claim on New Amsterdam, now New York.

THE THREE GUIANAS



You can see at once why the British, the Dutch, and the French were each glad to own a section of the Guianas. They are abundantly watered by rivers, and the alluvial coast plain, which was at one time under the sea, is now drained and diked, making rich productive land. Back of these lowlands the land rises, and still farther back there are hills, some of which are 2,000 feet high. This region is covered with great forests, with savannahs here and there, while farther south rise mountain ranges.

British Guiana, as its boundaries stand after decades of wrangling with Venezuela, contains about 90,000 square miles, and has a population of about 310,000. It is the only British possession in South America, aside from islands. More than two-thirds of the people are negroes and Hindu coolies brought in as laborers. There are between 15,000 and 20,000 Indians and about 3,500 Chinese. The Europeans are mainly Portuguese and British. Sugar, rum, molasses, gold, timber, rice, and balata (a substitute for gutta-percha) are the chief exports. There are only about 100 miles of railway, and transportation is carried on chiefly by water. The capital, Georgetown, which has a population of nearly 55,000, is below high-water mark and has to be constantly drained by canals and steam pumps. It is protected from the sea by a stone wall a mile long, and the houses are built on high piles. The governor of the colony holds his office by appointment from the British government.

Dutch Guiana, sometimes called by its old name Surinam, is about half the size of British Guiana, with a population of about 110,000, chiefly Hindu coolies, Chinese, Javanese, negroes, and other laborers. The most interesting people are the "bush negroes," descendants of runaway slaves who escaped to the forests and gave the government so much trouble in the latter half of the 18th century that it had to make treaties with them and grant them subsidies. Before missionaries had worked among them they had relapsed into a curious heathenism blended with survivals of Christianity. Cacao, coffee, sugar, rice, corn, bananas, and gold are the chief products; but the revenues of the colony fall below its expenses and have to be supplemented by grants from the Netherlands government. Nearly half the population live in Paramaribo, the capital.

French Guiana is the smallest of the three colonies, with an area of about 32,000 square miles and a population in the neighborhood of 30,000. It has always had a bad name from the terrible disasters which attended early attempts at settlement. In 1763 a colony of 12,000 came from Alsace and Lorraine, which was reduced after two years of hunger and disease to a fever-stricken band of less than 1,000. During the French Revolution it was made a convict settlement and is still used for that purpose. Devil's Island, near its coast, is famous as the place where Captain Alfred Dreyfus was imprisoned, the victim of an army plot which kept France in a political uproar for a decade. There is little industry and the imports exceed the exports. The capital of French Guiana is Cayenne, which gave its name to the red pepper of that name.

GUINEA-FOWL (ḡĭn′ĭ-). What a noisy creature this barnyard fowl is, with its unceasing cry like the rapid creaking of a rusty hinge! But it is becoming one of the most profitable inmates of our poultry yards, owing to the growing liking for its dark gamy flesh. The birds have a full squarish body, a small head and short tail, and very thick beautiful grayish plumage, marked with small white spots. They came originally from Africa and were common from the Guinea coast southward to the Cape of Good Hope. They are also found in the northern part of that continent where they have been domesticated since the days of the Romans.

The wild guinea-fowls are of three kinds—those with a crest of feathers on the head; those with a bony helmet and bare heads; and those with a patch of feathers on the back of the head. The crested variety is more graceful than the others; their plumage is black, dotted with small bluish-white or light green spots. The skin of the neck is bare, bluish in color, and sometimes ornamented with bright red. The helmeted variety, from which the domestic form is derived, go in large flocks. They are very noisy, fast runners, wild and wary. Some species of this kind live also in Madagascar. The domesticated guinea-fowls are of three varieties — peach, white, and lavender.

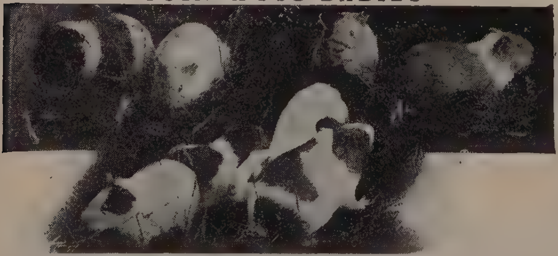
Guinea-fowls destroy many insects, their eggs are good, and their flesh is esteemed as a delicacy. But they are hard to raise as they have the bad habit of hiding their nests, and they are unpopular on account of their harsh monotonous cry.

AN AFRICAN GUINEA-FOWL

This Guinea-fowl is a native of Africa, where the whole Guinea-fowl family originated. But he is more lean and long-legged than our domestic fowls and is one of the swiftest bird runners.

GUINEA-PIG. This restless grumbling little rodent is curiously misnamed, for it is in no sense a pig, and is not native to Guinea, but to Guiana, Bolivia, Brazil, and some other parts of South America. Its real name is the *cavy* and it is related to the hares and rabbits. It was domesticated in Europe in the 16th century, and is frequently seen in the United States. The cavy is about six inches long, and exists in several varieties, some of which have short hair and others long curiously ruffled hair. The colors are varied, usually black and white, tan and white, or a mixture of all three. The little animals are gentle and amusing and are bred as pets for children. They are also in great demand as subjects for experiment in medical laboratories. They live wholly on vegetable food and while feeding generally sit on their hind feet. When free they live in burrows and feed at dusk and on dark days. The guinea-pig breeds rapidly and is capable of bearing young when but a few months old. Scientific name, *Cavia cobaya*.

GUINEA-PIG BABIES



Here are eight of the little youngsters tumbling about—an average family, for the domestic Guinea-pig has from four to twelve young at a time, depending upon the age of the mother.

GUITAR (*gĭ-tär′*). A stringed musical instrument resembling the lute, well adapted as an accompaniment to the voice in singing and much used in Italy and Spain. It was introduced into Spain by the Moors. It has six strings, which are played by the fingers of the right hand, while those of the left control the pitch by pressing on the fingerboard, which has frets (metal strips dividing it into notes) across it. The three highest strings are usually of gut, the three lowest of silk spun over with silvered wire.

GULF OF MEXICO. This great oval indentation of the Atlantic Ocean, more than 700,000 square miles in area, is almost completely surrounded by the United States and Mexico. Look at the map and see how the peninsula of Yucatan reaches up towards the downward sweep of Florida as if to hold it in, and how, in the 450-mile stretch between them, a portion of Cuba interposes, leaving the Straits of Yucatan, 120 miles wide, opening into the Caribbean Sea to the south, and the Straits of Florida, varying from 60 to 100 miles wide, the only passages to the open sea. From east to west the Gulf measures 1,100 miles, and from north to south 800 miles.

The greater part of the 3,000-mile coast line is low and marshy. It is outlined for much of its length by long barren sand-bars, sometimes 100 miles in length, with salt lagoons behind them. There are no islands in the Gulf, except Cuba, a few small ones off the coast of Yucatan, and the luxuriant little Florida Keys. The rivers emptying into it all bring down a great amount of sediment, which forms great bars at the mouth, so that all of them, except the Mississippi, are nearly inaccessible except for vessels of small draught. Because of the low shores there are only a few good harbors, the most important being those of Key West, Tampa, Pensacola, Mobile, Galveston, Corpus Christi, Tampico, Vera Cruz, and Havana. From Florida to the Mexican boundary the slope of the basin is very gradual, but off the Mexican coast it drops rapidly to the submarine plain known as Sigsbee's Deep, which is about 12,750 feet deep. The tides are relatively small in range, as we should expect in such an almost land-locked basin, rarely exceeding 4 feet for the spring tides and 2½ feet for the neap tides.

The Gulf exercises a great influence on the climate of the southeastern states and the whole Mississippi valley, saturating the southerly winds blowing across it with moisture, which falls as rain, most heavily on the coast and in smaller and smaller quantities toward the north. The temperature of its waters is eight or nine degrees higher than that of the Atlantic.

The Gulf of Mexico has had a long and vivid history. In Yucatan stand great ruins, remains of times before recorded history. Into its broad blue waters Cortez and his armies sailed on his expedition of conquest, and many other Spanish and French adventurers followed him. La Salle floated down the Mississippi out upon its surface and was later killed near the settlement he founded on its coast. Early in the 19th century Jean Lafitte, pirate and smuggler, established his headquarters on the island of Grande Terre in Barataria Bay and plundered traders and terrorized settlers. During the War of 1812 and the Civil War, important naval battles were fought at Mobile Bay and at New Orleans.

GULF STREAM. Because it carries warm water from the tropics to temper the climate of the north, the Gulf Stream has been called the "heating apparatus" of western Europe. It is the largest and most important of all the ocean currents, having a volume equal to all the rivers of the world combined. If the water that flows by the Straits of Florida in one hour could be evaporated, the remaining salt would require many times more than all the ships of the world to carry it. This great ocean river, a clear indigo-blue mass of water several degrees warmer than the surrounding ocean, is 50 miles wide at its narrowest point and its depth is about 2,000 feet. It flows at a velocity ranging from two to six miles an hour.

The stream receives its name from the Gulf of Mexico, where it originates. Driven by persistent ocean winds, aided by the rotation of the earth, it rounds the Florida shore, and then runs close along the coast of North America, separated from it by the icy waters of the Labrador current (here known as the "cold wall"). Off Cape Hatteras it curves to the east, under the influence of the increasing westerly winds and the rotation of the earth. Fanlike, it spreads as it journeys, growing gradually wider, shallower, and cooler, and merging in the general drift of warm water northeastward to Europe. As this Gulf Stream drift approaches the eastern Atlantic, it splits into two parts, one going south along the coast of Africa, and another turning north and dividing into three smaller currents which warm the British Isles, Scandinavia, and parts of Iceland. That is one reason why London and Paris, although no farther south than parts of ice-bound Labrador and Canada, enjoy a fairly mild climate, and Norway and Iceland are made habitable. Although scientists today consider the Gulf Stream a less important factor in the climate of Europe than they used to think it, there seems little room for doubt that it has a part in warming the southwesterly ocean winds which give the western coast of Europe so much milder a climate than corresponding latitudes on the east coast of America. The Gulf Stream serves another important purpose in keeping the harbors of northwestern Europe free from ice. (*See also* Ocean; Winds.)

Long-Distance FLYING CHAMPIONS *of the World*

GULLS AND TERNS. So far as we know, Mr. Gull was the first flyer to cross the Atlantic. Many reliable observers have testified that they have seen the same bird follow a vessel the whole 2,500 miles from the coast of Ireland to the harbor of New York, living on the refuse thrown out from the ship and occasionally resting, hydroplane-like, on the waves. As you would expect in birds capable of such long flights, the gull's wings are very long and powerful, able to make steady headway against the strongest gales. And it has webbed feet, so that it is equally at home in the water.

All gulls are great travelers, and most of them migrate enormous distances between their winter and summer homes. But the record for long-distance traveling does not belong to the gull, but to its near relative the tern. The Arctic tern regularly makes a round trip of about 22,000 miles between its winter and summer homes, for it nests as far north as land has been discovered, and as soon as the young are grown the whole family takes wing for the Antarctic continent. Both gulls and terns have amazing homing instincts and when taken about a thousand miles from home, will find their way back in a few days.

Those beautiful long wings have carried this mother Tern all the way from the other end of the world to her summer home in the Arctic region. In the fall, as soon as her young ones are grown, the whole family will start for the Antarctic region.

Gulls and terns are the most widely distributed group of the bird family, for there are about 50 species of each, scattered throughout the world. The gulls range in size from that of a pigeon to that of a goose, and terns are slightly smaller, with slenderer bodies. All these birds are very sociable and nest in colonies of thousands and sometimes millions. When they are disturbed they utter a series of harsh screams which almost deafen the intruder. But such destruction has been carried on in some of their breeding colonies, for the sake of the edible eggs, and so many of the adult birds have been slain for their plumage, that gulls have disappeared from whole areas of the American coast.

The prevailing color of the grown bird is white below and pearl gray above. In some species the head is more or less marked with black in summer.

A few species are dull gray all over. The feet and bill are usually bright yellow or red.

All gulls and terns are fond of fish, and greedily eat dead ones as well as any food refuse found floating on the water; thus the harbor and shore gulls are valuable scavengers. Inland gulls are valuable friends to the farmer because they eat field mice and the insect pests which do such harm to crops and trees. In Salt Lake City a monument, surmounted by bronze figures of two gulls, has been erected "in grateful remembrance" of the service rendered the state of Utah by gulls when, in 1850, the gulls came in large flocks and destroyed millions of black crickets, whose ravages for three years had threatened not only the crops but even the very lives of the settlers. (For illustrations in colors of common tern or "sea swallow" and herring gull, *see* Birds.)

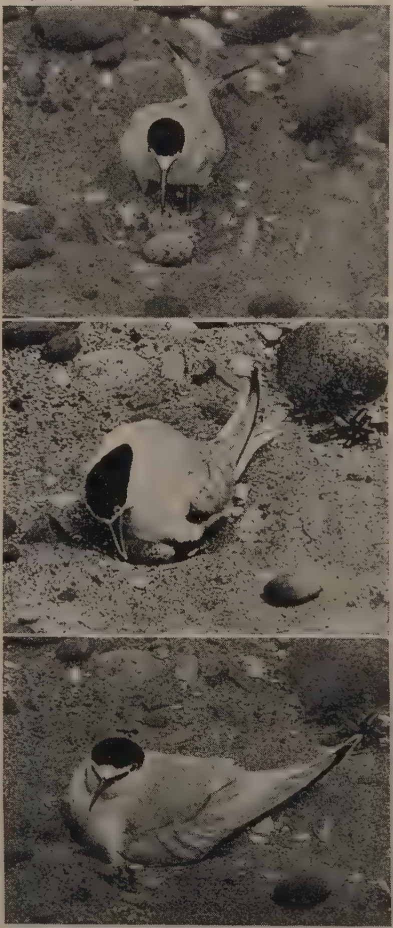
This is a Roseate Tern. This species of "sea swallow" is among the largest members of the family.

The herring gull is the species most abundant along the Atlantic coast, acting as scavenger in the harbors and following ships for scraps of food. It is very fond of clams, which it breaks open by dropping them from a height on the rocks. One case has been observed where a gull repeated this performance 14 times before the shell finally broke.

The California gulls are found not only along the coast of California but inland as far as Utah. It was this species that rid the Salt Lake country of its crickets. The birds nest about inland lakes and follow the irrigating ditches, often in company with the ring-billed gull, which is one of the commonest western varieties.

Franklin's gull is the common gull of the lakes and marshes of the upper Mississippi valley. These birds often follow the plow of the farmer, picking up worms and grubs, so he calls them his "prairie pigeons." Their nesting habits differ from those of other gulls. In great companies they seek marshy lakes, where they build floating nests only a few feet apart. The fledglings swim from the nest when only a few days old, making the lake fairly alive with floating puff-balls.

HOW MRS. TERN TURNS HER EGGS



Mother birds turn their eggs from time to time so that all parts will be equally warmed, but instead of first snuggling down on the eggs and then shuffling them about as hens do, Mrs. Least Tern rolls them around under her with her beak.

The laughing or black-headed gull, found near the salt marshes of the Middle and Southern states, is a handsome bird with a black mantle and a white breast flushed with rose. It is noted for its loud laughter-like cry, and for its trick of alighting on the pelican's head and snatching fishes from its huge beak.

Here you see two little Arctic Terns just hatched, and beginning to move about and take interest in life.

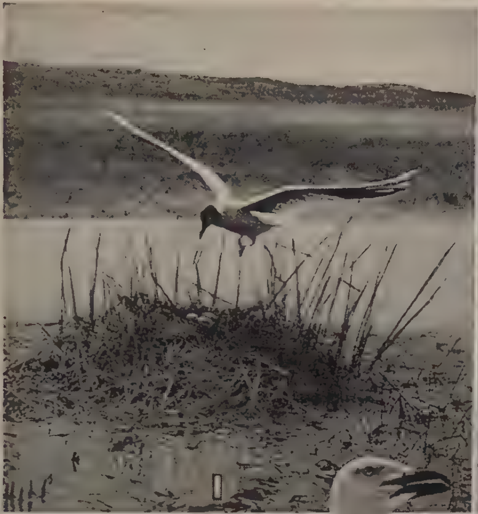
It is easy to tell terns from gulls, if you look closely at them. The terns are smaller and slenderer, and are more graceful in flight, as their nickname "sea swallows" indicates. Gulls usually have square tails, while most terns' tails are forked. A surer distinction is the upper bill, which is always ridged and hooked in the gulls. Their habits also differ, for gulls often alight on the water to feed, while terns always hover and plunge for their food. Another distinction is that gulls usually fly with their bills on a line with the body, while terns carry theirs pointed downward.

The common tern is found in all parts of the Northern Hemisphere, as well as in South America and Africa. They often hover over schools of fish, and fishermen find them of great service in the locating of fish for them. The royal tern is not only the most conspicuous of the family, but is one of the handsomest. It is entirely white or pearl gray except for its glossy black crest, black legs, and a bright orange-colored beak.

The least tern is the daintiest of all sea birds. Only about nine inches in length, it is a pale blue color above and white beneath. But its slender pointed wings and tail have made it a prey to the feather hunters, who pursue it so cruelly that even rigid laws have not sufficed to protect it.

Gulls and terns compose the family *Laridae* of the order of long-winged swimmers, *Longipennes*. Scientific name of herring gull, *Larus argentatus*; common tern, *Sterna hirundo*.

SOCIETY NOTES ABOUT GULL AND TERN LIFE



1. Mrs. Black-Headed Gull is returning to her nest after an afternoon's call on the neighbors. 2. Baby Black-Head has been caught crawling out of his nest and is getting a good scolding. 3. The Great Black-Backed Gull seems to be posing for his picture, while his mate looks on. 4. The Herring Gull is looking around for a bite to eat. 5. Mrs. Arctic Tern is rising from her nest at the approach of an intruder. 6. Mrs. Roseate Tern is at home.

GUMS. The gums with which we are most familiar are those used for chewing, such as chicle, cherry gum, and spruce gum, but gums have important industrial and medicinal uses also. All gums are the juice or sap exuded from certain trees or shrubs. There are about 150 varieties known to commerce, most of which are used in varnishes, candies, drugs, and various industrial preparations.

True gums are partially soluble in water, but not in alcohol, while waxes and resins are soluble in alcohol and not in water. In popular usage, however, the word gum is applied also to true resins and to gum resins, or mixtures of gum and resin (*see* Resins). The purest and best gums come from various species of acacia (*see* Acacia). Most chewing gum is made from chicle gum, which comes from the naseberry, a tree of tropical South America, somewhat like the India rubber tree (*see* Chewing Gum).

Gum arabic is one of the most useful of the gums. It is brought into the market in the form of roundish tears, which vary in color from garnet red to light straw, and are always more or less transparent. The lightest colored varieties are the best. It is employed in the manufacture of confectionery, such as marshmallows, gumdrops, and "Turkish delight," and used in pharmacy for soothing and softening lotions. It is also used in making mucilage and adhesive paste, to give luster to crepe and silk, and to stiffen other fabrics. It comes from varieties of acacia in Turkey, Australia, northern Africa, and to a limited extent, in Texas and Mexico.

THE USEFUL TRAGACANTH

The lump of Gum Tragacanth you see underneath the plant will take up enough water to make 50 times its own weight of mucilage.

Gum tragacanth, which comes from Asia Minor, will take up as much as 50 times its weight of water, and thus makes a thick mucilage. It is used also as a thickener for colors and mordants in calico-printing; in medicine as a vehicle to bind insoluble powders; and in preparing beetles and other insects as museum specimens. Bassora gum, from a species of cactus, is similar to tragacanth and is sometimes used to adulterate tragacanth.

Kauri gum is the resin of the kauri pine of New Zealand. Most of it is obtained in fossil form. It is used in making fine varnishes. The copal gums, which are also used in varnishes, are fossil resins from Zanzibar, Madagascar, and many places in the East.

Other important gums are gamboge, a gum resin obtained in Siam, Cochin China, and Ceylon, used as a yellow pigment and in medicine; mastic, which comes from the eastern Mediterranean countries and is used in Turkey as a chewing gum, and elsewhere in pharmacy, and in making a very fine varnish. Plastic gum is another name for gutta-percha (*see* Gutta-Percha).

THE KAURI AND ITS GUM

Most Kauri Gum is obtained by digging up the fossil deposits left by the kauri trees of past ages. This picture shows the leaf, the cone, and the fossil gum.

GUNCOTTON. A violently explosive substance made from cotton or some other form of cellulose treated with nitric and sulphuric acids. It is largely used in naval and military mines and torpedoes. (*See* Cellulose; Collodion; Explosives.)

GUNPOWDER. The date of the invention of gunpowder is in doubt. In fact, it cannot be said to have been invented by any one man, for it was a gradual development from various "fire" substances, long known in many countries before they were adapted to military use. The Chinese early had a knowledge of some such incendiary substance; and the "Greek fire," first used by the defenders of Constantinople against the Saracens in 673, is believed to have been somewhat similar to modern gunpowder. It was not employed to propel balls, however, but was simply set on fire and poured or hurled on the besiegers beneath the walls.

The English Franciscan friar Roger Bacon (died about 1294) and the German monk Berthold Schwartz (early 14th century) share the honor of having been the first to give a scientific account of the composition of gunpowder. The use of it in cannon is first mentioned in the records of the city of Florence, under the date 1326. One chronicler mentions the use of cannon in the battle of Crécy (1346), but if used they did little more than frighten the horses and men. Gunpowder's first important use was in blowing up or battering down the castle walls of rebellious barons. Later it was used in small arms and helped to make the common man with a musket more effective in war than the mounted knight in armor.

The gunpowder of the early days was much the same as the common black powder of today. It consisted of a mixture of saltpeter (potassium nitrate or niter), charcoal, and sulphur. The proportions of these chemicals have varied greatly from time to time, a fair modern standard being 75 per cent saltpeter, 15 per cent charcoal, and 10 per cent sulphur. These ingredients are ground to a fine dust, thoroughly mixed into a moist paste, pressed into cakes, and dried. The cakes are then broken by rollers into grains of varying size, which are glazed by friction against each other in revolving barrels. The charcoal used in gunpowder is specially prepared from dogwood, willow, or alder. All operations are carried on in small separated buildings that so the danger of great destruction by accidental explosions is reduced to a considerable extent.

Except for blasting work and certain special military purposes, the old style gunpowders have been almost entirely replaced by the smokeless powders and the high explosives, such as guncotton, nitroglycerin, and dynamite (*see* Dynamite and Nitroglycerin; Explosives). Smokeless powders (products of guncotton and nitroglycerin) were first perfected in 1884 and put to military use by the French.

GUSTAVUS ADOLPHUS, KING OF SWEDEN (1594–1632). For 12 years in the first half of the 17th century Germany had been devastated by the Thirty Years' War. Towns had been destroyed, men, women, and children massacred, and the country plundered. Everywhere the Catholic and imperialist party was triumphant, and it seemed as though the Protestant faith would be swept out of the land. But in 1630 the tide was completely turned by the appearance of a new leader for the Protestants—Gustavus Adolphus, king of Sweden, one of the greatest generals of modern times.

Born in Stockholm castle, he had been trained from childhood for his kingly duties. When he was only nine years old he began to take part in public affairs, and in 1611, at the age of 17 he had mounted the throne as Gustavus II. So carefully had he been trained that before he was 20 years old he had won a war against Denmark, and by 1630 he had extended his kingdom around the whole eastern shore of the Baltic by successful struggles with Russia and Poland.

GUSTAVUS ADOLPHUS BEFORE HIS LAST BATTLE

Gustavus Adolphus is praying for divine aid just before the Battle of Lützen. His army scored a brilliant victory, but the great king was killed. Near the spot where he fell a granite bowlder was placed on the day after the battle and in 1832 a cast-iron canopy was built over it.

Gustavus Adolphus was led to enter the Thirty Years' War not only because he was an enthusiastic Protestant, who hoped to relieve the misfortunes of the Protestant cause in Germany, but also because he dreamed of extending his kingdom even to German shores, so that the Baltic might indeed become "a Swedish lake." France under Cardinal Richelieu as minister gave him money for his expedition, to further French political aims.

When Gustavus landed in the north of Germany his army was not large, but it was well trained and disciplined. He was the greatest military genius of his age, being the first of modern commanders to supply his army from a fixed base instead of leaving it to live off the country by foraging and pillage. At first he was coldly received by the Protestant rulers of Brandenburg and Saxony, but they were brought to their senses after the awful destruction of

Magdeburg by the imperialist forces and the foolish religious policy of Emperor Ferdinand II. In the famous battle of Breitenfeld, near Leipzig (Sept. 17, 1631), Gustavus overwhelmingly defeated the imperialist army under its famous commander Tilly.

Gustavus then pushed westward, through the "priests' lane" of rich bishoprics and monasteries of the River Main, to Mainz on the Rhine, where he established his brilliant winter court. In the spring he again took the field, and a second time defeated and now mortally wounded the aged Tilly in Bavaria. In this emergency the emperor took the humiliating step of recalling the imperialist general Wallenstein, whom he had dismissed just after Gustavus had landed on German shores.

After weeks and months of maneuvering, one foggy day in November 1632, Gustavus succeeded in bringing Wallenstein to bay at Lützen, only a few miles from the site of his first great triumph. Again the Swedish troops gained the victory, but the battle was won at the cost of the life of their beloved king, for Gustavus fell wounded into the hands of the enemy and was dispatched as he lay. He was the greatest king that Sweden ever had. With his death "all moral and religious ideals died out of the Thirty Years' War," and it became a mere struggle for political power. (*See also* Thirty Years' War.)

GUTTA-PERCHA. On the other side of the world, in the rain-drenched Malay Peninsula and the neighboring islands of Java, Borneo, and Sumatra, grow forests of huge gutta-percha trees. Their spongy wood is useless, but between the wood and the bark is found a milky juice or "latex," which when it is concentrated by boiling produces a reddish-gray substance something like rubber.

This is the gutta-percha which made the ocean cable possible and which has many other important uses. It is a non-conductor of electricity, is unchanged by water, and can be easily worked when warm, retaining its shape and becoming leathery but pliant when it cools. So perfectly does it fulfil the demands for cable insulation that five-sixths of the submarine cable mileage of the world has a gutta-percha covering.

Gutta-percha is often confused with rubber, because both are the dried juice of trees and resemble each other in many properties. Like rubber, gutta-percha is waterproof and can be "vulcanized" with sulphur, in which form it is often miscalled hard rubber. But it is not elastic, and unlike rubber it softens in warm water so that it can be drawn into fine sheets or molded into any form, retaining impressions to the finest detail when it becomes cold and hard. It is prized for making certain kinds of surgical instruments and plates for false teeth, and it is also employed in the manufacture of buttons, golf balls, knife handles, etc. Inferior grades are used in waterproofing.

GUTTA-PERCHA LEAVES

The leaves of the great Gutta-Percha trees grow in clusters at the end of the branch. They are usually about 6 inches long and 2 inches wide at the middle. The flowers are white and very small.

Gutta-percha has been known in western countries only since the middle of the last century, but in China it has been used much longer. The world's supply is rapidly diminishing and may soon disappear unless the methods of collecting the sap are changed. Since the juice flows very slowly, the usual practice is to cut down the trees to collect the "latex," of which a large tree yields only two or three pounds. This wasteful method has exterminated the trees in many districts in which they were formerly abundant. In a few places the trees are tapped as for rubber, and a few plantations have been started. Because of the increasing scarcity of gutta-percha, rubber is replacing it for many uses, especially as a coating for land- and sea-cables.

The trees supplying gutta-percha belong to the family *Sapotaceae*, the principal one being *Isonandra gutta*. The true gutta-percha is obtained from trees found only in the Malay Peninsula and its vicinity, although several natural substitutes are obtained from other trees and plants, of which the material known as "balata" or "Surinam gutta-percha" is the most valuable. This is obtained from the bullet tree, *Mimusopa balata*, which grows in the West Indies and South America. Various artificial substitutes have been invented, chiefly for use in electrical insulation. They consist of mixtures of bitumen with linseed and other oils, resins, and other similar substances.

GYPSUM. This is a very abundant mineral composed of calcium sulphate in combination with water. Translucent varieties are known as "selenite," and very fine grades of the material, of white color and special luster, are known as "alabaster." When heated, part of the water of the gypsum escapes and the mineral becomes a white powder known as "plaster of Paris," the name being due to the fact that gypsum was early used near Paris for the making of plaster or cement. If moistened, this powder "sets." Plaster of Paris is used for making casts by sculptors and in surgery. When the material sets it increases a little in volume, which makes all the details reproduce exactly. Plaster of Paris is also used sometimes in making stucco, and for fertilizer on land, where it facilitates the decay of forms of alkali.

For making plaster of Paris the whiter and purer grades of gypsum are ground in mills and calcined in large kettles, which are usually about six feet deep and eight feet in diameter. Heat is applied from below and revolving arms constantly stir the gypsum.

Other important uses for gypsum are as a filler in paper and in the manufacture of ornamental stucco work. Much gypsum is also used for beds in polishing plate glass. Raw gypsum is used as a basis for paints, to which the pigments are added. Calcined gypsum mixed with a small amount of sodium or potassium sulphate is used for flooring, ceilings, or walls.

Gypsum occurs in various states of the United States, notably Iowa, Kansas, Michigan, New York, Ohio, and Texas. The workable beds are deposited in salt lakes. As the salt water becomes more and more concentrated, the gypsum is precipitated before the salt. Gypsum is therefore often associated with salt deposits. It also occurs in many sedimentary rocks in the form of single crystals or in groups of crystals. In some parts of the West, as in parts of New Mexico, gypsum occurs at the surface, and its fine particles are blown about like sand.

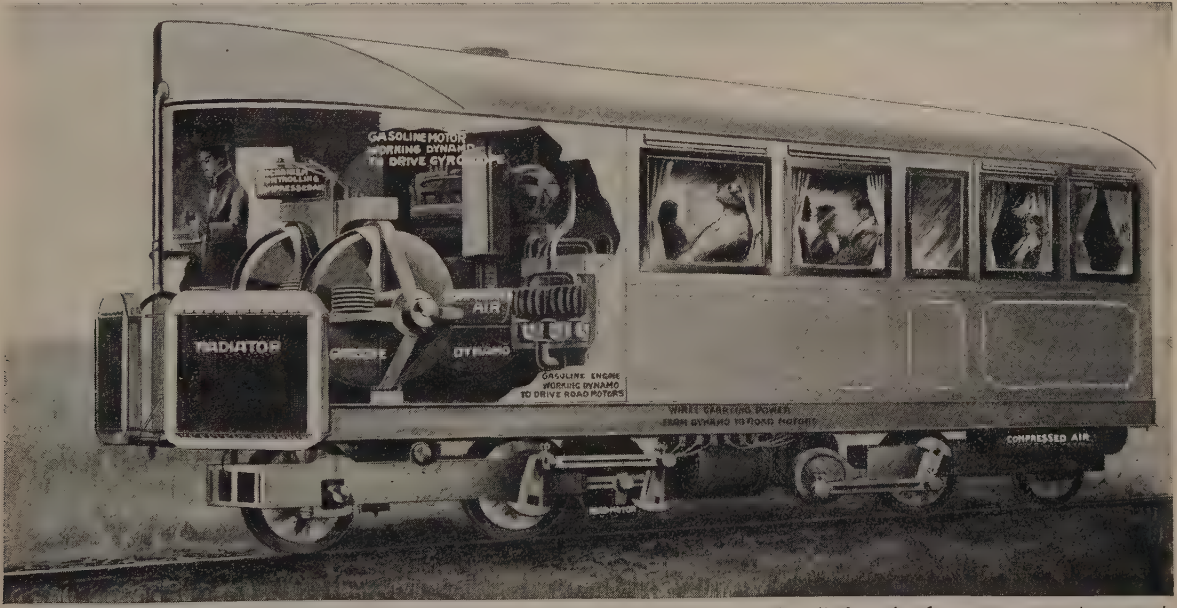
GYROSCOPE. (*ġȳ'rō-skōp*). You know how a top will remain upright in resistance to the force of gravitation as long as it keeps spinning. Now imagine a wheel-shaped top, pivoted top and bottom inside a framework, and rotating rapidly. It will give to that framework the same strong tendency to remain at the angle at which it is placed that the top has when it is spinning alone. In other words, the axle of the rotating wheel cannot be turned quickly from its position except by the application of some strong force. This is the principle on which that mysterious device called the gyroscope works, whether it is the toy that everyone knows, or the elaborate apparatus which men of science have applied to important stabilizing purposes at sea, on land, and in the air.

Every battleship in the United States Navy is now equipped with a gyrocompass (perfected by the American Elmer A. Sperry about 1910), which is entirely independent of the earth's magnetism and is much more accurate than the magnetic compass. The gyroscope is used in the steering mechanism of the torpedo to keep it straight on its deadly journey under the waves. It may also be used to steady the ship's telescope so that the navigator may make observations while the ship is rolling and pitching in a stormy sea; but even the rolling of a ship may be checked by Sperry's application of the gyroscope in the form of a huge stabilizer in the ship's hold. On the other hand, it has been possible by gyro apparatus to produce artificial rolling for ice-breaking vessels used in keeping ports open in winter.

On land, the gyroscope makes possible the monorail car, which remains upright even when rounding sharp curves on its track with a single rail; and in the air the gyroscope has been successfully used as a stabilizer for airplanes.

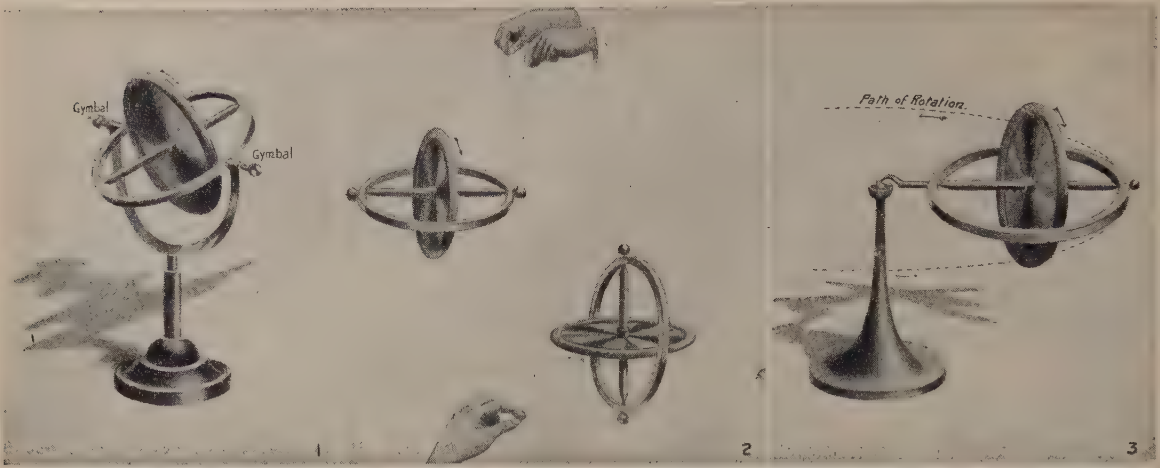
The fundamental principle underlying the gyroscope is that when a wheel or disk-shaped body is rotating rapidly about its axis, the body offers great resistance to any effort to change the direction of that axis. If you examine a toy gyroscope you see that it consists essentially of a heavy-rimmed wheel rotating on an axle mounted in a ring which itself does not revolve. When the wheel is rotated with sufficient speed the gyroscope performs surprising antics, such as running down a stretched thread without falling over, and spinning on the edge of a tumbler, or on the point of a lead pencil. You cannot push it over with-

THE CAR THAT RUNS ON ONE RAIL


GASOLINE MOTOR
WORKING DYNAMO
DRIVE GYRO
RADIATOR
AIR
DYNAMO
GASOLINE ENGINE WORKING DYNAMO TO DRIVE ROAD MOTORS
WIRES CARRYING POWER FROM DYNAMO TO ROAD MOTORS
COMPRESSED AIR

Many ingenious inventors have proposed to run street cars and railway trains on single rails by using huge gyroscopes to prevent the cars from tipping over. Small models, such as this, have been built and operated with success. Some day, perhaps, we shall all be riding in such swift, smooth conveyances, held up by the mysterious force of heavy whirling wheels.

SOME OF THE QUEER ANTICS OF THE GYROSCOPE



At the left you see how the principle of the gyrocompass is demonstrated. Set that disk spinning, point its axis in a certain direction, and you can tip the supporting frame in any way you wish, but the whirling axis will keep on pointing as it was first fixed. In the middle picture you see a gyroscope top holding itself up by its motion while it projects at right angles from a loop of string, and another top "walking a tight-rope." The picture at the right shows the "double motion" of a gyroscope whirling about a central point of support.

out applying a comparatively strong force, for it resists you with a force many times its entire weight. This same principle explains why modern rifles and cannon are rifled or bored to make the bullet or shell rotate, so that the gyroscopic action will keep the point of the projectile foremost as it whizzes through the air to its target.

When you do overcome the resistance and tilt the gyroscope—and you may tilt it at almost any angle short of actually toppling it over—you are astonished to find that not only does the wheel continue to spin at the new angle, but the whole apparatus turns in a circle about the spinning point, thus compounding two simultaneous rotations. This action has often been used to illustrate the various motions of the earth—its daily rotation about its axis, its annual revolution in its orbit, and a slow rotation or "wobbling" of its axis, called the "precession."

The gyroscope was invented probably in the early part of the 19th century, although by whom is uncertain. Its properties were studied by the French scientist Foucault in 1852.

HABEAS CORPUS (*hā′be-as côr′pŭs*). When a person is imprisoned or held anywhere against his will, a court of law may upon reasonable demand issue an order compelling the jailor or other custodian to produce the person in court and show by what right he is held captive. If no lawful reason is found the prisoner is released. This court order is called a writ of habeas corpus, often known as "the great writ of liberty." It is probably the most important of all legal safeguards against tyranny.

Habeas corpus is a Latin phrase meaning "produce the body." The principle of this writ is of ancient English origin, for in Magna Carta King John was forced to promise that "no free man shall be taken or imprisoned except by the lawful judgment of his peers and by the law of the land." Under this principle no one could be arrested and held in confinement on mere suspicion, without being formally accused of a crime.

This remained one of the mainstays of English liberty until Charles I set up the claim that a royal command was a sufficient answer to a writ of habeas corpus. This misguided policy with similar arbitrary acts cost the king his life. The result was that under Charles II the famous Habeas Corpus Act was passed, which extended the principle to mean that any person who was imprisoned for any crime except treason or felony, could demand and obtain his freedom under bail—that is, the pledge or bond of some responsible person to pay a fixed sum of money if the accused person failed to appear for trial.

The amusing manner in which this law passed the House of Lords is told by Bishop Gilbert Burnet in his memoirs. The lords who approved the bill had all filed out, as is customary when voting, and were returning to be counted as they entered the door, "Lords Gray and Norreys were named to be tellers," says Bishop Burnet. "Lord Norreys, being a man subject to vapors, was not all attentive, so, a very fat lord coming in, Lord Gray counted him for ten, as a jest at first; but seeing Lord Norreys had not observed it, he went on with this misreckoning of ten, so it was reported that they who were for the bill were the majority, though it indeed went to the other side."

The Constitution of the United States declares that the "privilege of the writ of habeas corpus shall not be suspended, unless, when in cases of rebellion or invasion, the public safety may require it." The privilege was suspended by President Lincoln during the Civil War, at first without the sanction of Congress. In 1863 Congress voted to give the President that power.

HABIT. The ordinary person thinks of smoking, chewing gum, or personal peculiarities such as holding one's head on the side, as habits. He does not think of walking, skating, and catching a ball as habits, nor of the movements of his eyes in reading, or of his hands in playing a piano. Habit enters so largely into man's daily activities that it would be impossible for him to exist without it. He could not communicate with a friend without making use of the habits of enunciation or writing that he formed with great difficulty in childhood. If he had not made it a habit he might be occupied all day in dressing and undressing himself, for the fastening of a button or the combing of his hair would be as difficult as when he first tried it as a child. He would, moreover, be completely tired out from his exertions. But habit enables him to do these things speedily and accurately, yet almost unconsciously, and so leave his mind free for other matters.

Habit formation has been likened to the making of a path across a field. After the first traveler has trodden down the grass, the next is likely to follow in the same route, and so on until presently the grass is wholly worn away and everyone thereafter follows the beaten path. In the same way in the animal organism, nervous currents tend to employ those pathways which have been previously established, and thus many of our habits formed when we are young—such as posture, personal cleanliness, manners, and standards of dress, enunciation and tone of voice, and even moral habits—become permanently settled upon us. Prof. William James has told us of the drunken Rip Van Winkle who excused himself for each fresh relapse by saying, "I won't count this time." "He may not count it," says James, "but it is being counted nevertheless. Down among his nerve-cells and fibers the molecules are counting it, registering and storing it up to be used against him when the next temptation comes." To break up a habit means a complete change in the nervous system, and this can not be brought about solely by a penitent attitude of mind.

It is equally important for parents to remember that habits originate not only in conscious effort to do new things, but in conscious and unconscious imitation of what the child sees and hears about him. One of the main businesses of life is the formation of correct habits, for habits are the substance of conduct and character. To each of us comes the day when we realize the "law of human souls that we prepare ourselves for sudden deeds by the reiterated choice of good or evil that gradually determines character."

HADDOCK. A member of the cod family, resembling the common cod, but easily distinguished from it by the black lateral line, that of the cod being white. Though it usually ranks as inferior to the cod, it is nevertheless, one of the world's great food fishes. It is caught on the same grounds and by the same methods as the cod. "Finnan haddie" is smoked haddock. (*See* Fish).

HADES (*hā'dēz*). When the three greatest gods of Greek mythology, so the story goes, divided the world among themselves, Zeus obtained dominion over the heavens and upper regions, Poseidon became ruler of the sea, while Hades gained sovereignty over the underworld. Here in the realm of darkness Hades sat enthroned with his wife Persephone and ruled the spirits of the dead. He possessed a helmet which rendered him invisible. The Greeks pictured him as of stern and gloomy aspect, not to be moved by prayers and flattery. No temples were dedicated to him and when sacrifices were offered to him the ceremonies were dismal and only black animals were used.

So hated and feared was Hades as the god of the dead that the Greeks dreaded to call him by his real name. In later times they gave him a more kindly character and called him Pluto, "giver of wealth," for they believed that he controlled all the precious minerals that lay hidden in the depths of the earth, and even the grain that springs forth from the ground.

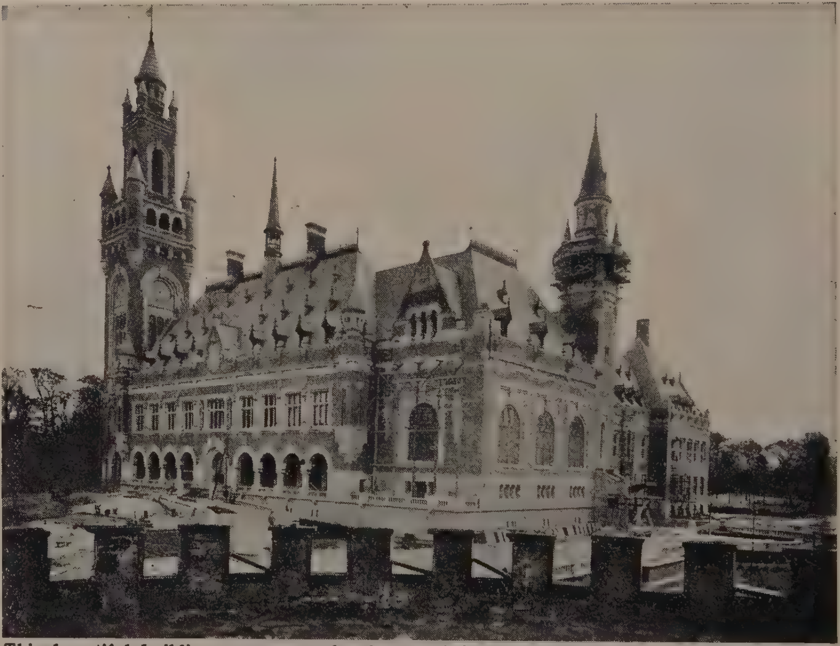
The term Hades came to be applied also to the abode of the dead. This was generally thought of as a place where the souls of the good and the evil alike led a dim shadowy existence, though there also grew up the idea of Elysium or the Elysian Fields, a paradise for those deserving special reward, and Tartarus, a deep pit under Hades where the wicked dwelt in eternal torment. Before passing into Elysium, souls drank of the waters of Lethe, the river of oblivion, that they might forget their sorrows.

To enter Hades, the dead were ferried across the River Styx by the boatman Charon. Only those who had received proper burial were allowed to go across, and if a body remained unburied, the shade must wander on the bank for 100 years before crossing. On the farther side of the Styx stood the many-headed dog Cerberus, guardian of the realm of Hades, who kept any who entered from returning.

HAGUE (*hāg*), **THE.** The capital of Holland, situated in a broad plain two miles from the North Sea, is like a plump and comfortable Dutch matron, clean and prosperous and well satisfied with life. Like Washington it is not a commercial city, but is chiefly occupied with the business of governing. It is the residence of the court of Holland, and it was for long the diplomatic capital of Europe, where many momentous international conferences were held. Since 1899 it has been the seat of the international court of arbitration, or Hague Tribunal, for which Andrew Carnegie built a splendid palace.

The original Dutch name of the city was "'s Gravenhaag" ("the Count's Grove"), which is shortened to "den Haag." The name comes from the fact that long ago the counts of Holland had a hunting lodge there. The city was once in a heavy wood, most of which has now been cut down. Only a little patch is left between The Hague and Scheveningen, the most popular seaside resort of the country, which is only a few miles from The Hague.

THE PEACE PALACE AT THE HAGUE



This beautiful building represents the dream of Andrew Carnegie and other workers for world peace. It was built to provide a home for the Permanent Court of Arbitration, and to house a library of international law.

Broad shaded streets intersected by many picturesque canals, and fine old buildings make the city one of the handsomest capitals of Europe. Its greatest pride is in its celebrated picture gallery, the Mauritshuis, which has many of the world's most beautiful and famous pictures. Here are masterpieces by the famous Dutch artists, Rembrandt, Rubens, Van Dyck, Vermeer, and others. There is also a very fine gallery of modern paintings which were collected by the eminent Dutch painter, Hendrik Willem Mesdag. Population, about 350,000.

HAGUE PEACE CONFERENCES. Before the World War of 1914–18, the most promising movements for world peace were the two peace conferences which met at The Hague in 1899 and 1907, on the call of the czar of Russia. Twenty-six countries, including the United States, attended the first, and almost twice that number were present at the second meeting.

The immediate objects of the conferences were (1) to find some basis on which the different countries could mutually reduce their armaments, and (2) to consider an agreement for settling international disputes by arbitration instead of war. Germany opposed both proposals. A member of the German delegation at the first conference said to one of the American delegates: "Germany is prepared for war as no other country is or can be. Arbitration would simply give rival powers time to put themselves in readiness, and would therefore be a great disadvantage to Germany."

German opposition prevented even the mention of disarmament in the second conference. The chief result of the meetings was the establishment of the Hague Tribunal, in the form of a permanent panel of judges to whom cases for arbitration might voluntarily be assigned (*see* Arbitration).

SIR DOUGLAS HAIG
Leader of England's Armies in the World War

Thirteen "conventions" or agreements were also adopted concerning various possible subjects of international disputes, and a series of regulations respecting "the laws and customs of war." Among other things, these prohibited the use of asphyxiating or poison gases in war, limited the use of submarine mines, and (for a limited period) dropping bombs from balloons and airplanes. Unfortunately the Hague regulations together with other provisions for making war more humane, were disregarded—first by the Germans and then by the other nations—in the World War of 1914–18.

HAIG, SIR DOUGLAS (born 1861). To the unwavering courage and military foresight of a scholarly gentleman of middle age, with a firm jaw and steady gray eyes, was largely due the final successes of the British arms on the western front in the World War. For the soldier on whom the British pinned their faith was Sir Douglas Haig, commander-in-chief of the British forces in France and Belgium.

At the beginning of hostilities Haig was a lieutenant-general, in command of Aldershot, England's great training camp. When the British army threw itself across the channel to stop the first German avalanche, he commanded the 1st Army Corps. In those black days his courage and optimism were a great help to the men, whose confidence he always held. In December 1916, he was appointed commander-in-chief with the rank of Field Marshal, and this position he held with honor till the end of the war.

Haig was born in Scotland, studied at Oxford, and joined the 7th Hussars in 1885. He saw his first active service under Kitchener in the Nile expedition, where he distinguished himself and was raised to the rank of major. He served also with distinction in the Boer War, and was made chief of staff to Sir John French, whom he afterwards succeeded as commander of the British army in the World War. At the close of the war he was created Earl of Bemersyde in the British peerage.

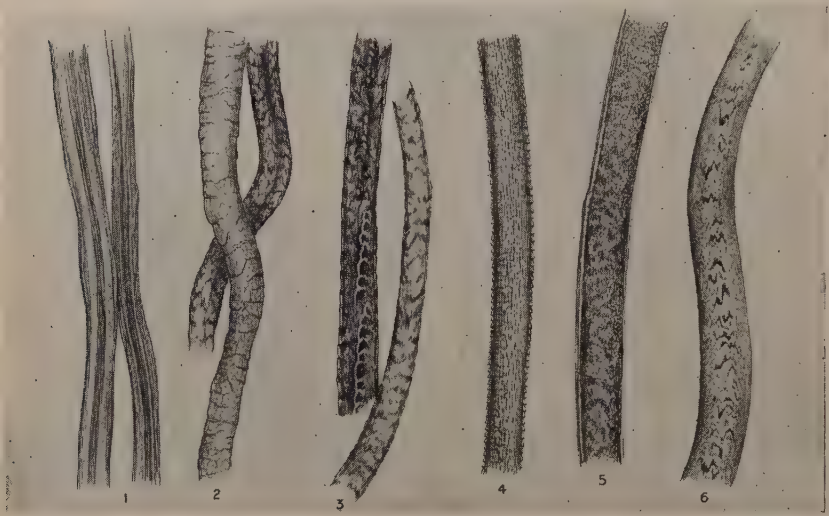
HAIL. The rolling white squall cloud that you sometimes see at the beginning of a thunderstorm is a "hail factory." The air in it is whirling along a line parallel to the earth. If a raindrop is caught and carried up high enough it turns to snow. When it comes down it is coated with water; on rising again, it freezes. The longer it travels the larger it gets; each coat freezes in turn until the mass of ice is so heavy that it falls to the earth in the form of hail. The more violent the whirl, the larger the hailstone will be before it falls. Some have been seen as large as eggs and there are records of storms in which hail covered the ground to the depth of a foot. Great destruction sometimes attends such storms, animals and even men being killed.

Frozen rain is sometimes called hail when it should properly be termed "sleet." Soft hail which sometimes falls in winter is merely a form of snow. Real hail is always a part of a thunderstorm, and therefore is most likely to occur on hot summer afternoons.

HAIR. The possession of hair is a distinguishing mark of mammals, as the possession of feathers is of birds, though the thickness of the hairy coat varies greatly in different creatures, and is even reduced to a few sparse hairs in such mammals as the hippopotamus and especially the whale. The possession of these warm coats of hair and feathers was one of the factors which enabled mammals and birds to develop so far beyond their common ancestors, the reptiles. Animals which live in cold regions—for instance, the Shetland pony and the polar bear—show a tendency to grow much heavier coats than those which live in a temperate climate. In some mammals, as the hog, the hair develops into long stiff bristles, in others, as the porcupine and hedgehog, these bristles are greatly enlarged and toughened to form protective spines.

In human beings no hair is found on the palms of the hands and the soles of the feet. The hair of the head is protective; the presence of hair elsewhere is probably only a relic of the heavy hairy coat worn by our remote prehistoric ancestors. The hair of the human head and beard is constantly being shed and replaced. Most of the lower animals have "shedding periods" when the hair begins to come out and to be replaced with new.

HOW HAIR DIFFERS FROM OTHER FIBERS



In these enlarged pictures you can see the difference between animal hair and such fibers as silk (1) which can be woven into smooth soft fabrics. Wool (2) is typical of all hair, with a rough scaly surface. Rabbit hair (3) also has large scales. Human hair (4) possesses a fine scale, while camel hair (5) and horse hair (6) have an almost horny surface. It is because of the scales, which interlock and cling together, that many kinds of animal hair can be matted into felt.

Each hair grows at its root from a tubular "follicle" or sheath in the skin. It is provided with a blood-vessel which feeds it and carries away its waste, glands which provide oil to keep it moist and soft, and nerves which control the blood-vessel and a muscle (the "hair erector") which by contracting makes the hair "bristle" or "stand on end," like the hair on the tail of an angry or frightened cat or the hair in the coat of an angry dog. When cold also an animal will sometimes "ruff up" its coat.

Each hair is a strong, flexible, elastic thread, composed of many horny cells. Some hairs are straight, others wavy, and still others "frizzy" or woolly. Microscopic examination of the cut end of a straight hair shows that it is round, while a curly hair is elliptical in cross-section. Anthropologists have used these differences in texture of human hair as a basis for classifying mankind into the straight-haired, the wavy-haired, and the woolly-haired (sometimes also the frizzy-haired) races, the first including the Chinese and other yellow peoples and the North American Indians, the second the "white" peoples, the third the negroes, and the fourth the aboriginal Australians and Nubians.

The color of hair is due to a pigment in the cells; this is lacking in white hair. The hair of the straight-haired, woolly-haired, and frizzy-haired peoples is uniformly black; the varying shades of brown, yellow, and red hair are found only among the wavy-haired peoples. Unhealthy conditions of the skin may affect the hair, making it dry or brittle or causing it to fall more rapidly than it should.

The hair of many animals is of economic importance. The hair of the sheep, goat, camel, vicuña, alpaca, and others is woven into cloth. The hair of rabbits, hares, and other animals is made into felt for hats. Cow-hair is used in making mortar and certain coarse cloths. The hair of horses is made into horse-hair cloth (used for stiffening garments and for upholstery) and into fishing-lines. The hair of the camel, badger, and other animals is used in making artists' brushes. Pig-bristles are made into various kinds of brushes.

HAITI (*hä′tĭ*), **REPUBLIC OF.** In the center of the chain of the West Indies, close to the east end of Cuba nestles the rugged island of Haiti. Only the western third is occupied by the Republic of Haiti, but this area contains three times as many people as the Republic of Santo Domingo in the east. No island in the world has been more favored by nature than this "black man's paradise," in which less than ten per cent of the people have any white blood. High mountains tower 7,000 feet above it, covered with valuable woods and filled with undeveloped mineral wealth in gold, silver, copper, iron, and coal. Rainfall is abundant, and the valleys are so fertile that the slightest attention can make them produce in tropical abundance.

Yet, in spite of its natural riches, no spot on earth was more neglected and poverty-striken until a few years ago than Haiti. Revolutions and misgovernment had reduced it to a miserable condition, and its capital, Port au Prince, was shunned by even the most enterprising travelers because of its filth. Then in 1915, the republic became a ward of the United States, and a new era dawned. In that year its president, General Guillaume Sam, was murdered, and a reign of terror began. European countries to which Haiti was in debt threatened to intervene, and the United States felt obliged, under its Monroe Doctrine, to send troops to restore order and administer the finances. Once begun, the task of supervising Haitian affairs had to be continued.

IN THE CAPITAL OF THE NEGRO REPUBLIC

It is market day in Port-au-Prince, capital of Haiti, and the people are crowding around the open air "stores" in front of the Roman Catholic cathedral. Until the American marines took charge in 1915, the city was exceedingly unclean and plague-ridden, but now the people have been taught to a great extent the value of public sanitation.

The United States "occupation" has done much to clean up the country and to stamp out the scourge of disease. The broad streets of the capital have been paved with asphalt, and scores of automobiles may be seen on them. The refuse and smells have departed; children have been made to attend school; electricity lights the capital; and a short tramway has been built, in addition to the railroad which connects the city with other important towns. The adjustment of taxes has given more incentive to agriculture, and in addition to excellent coffee, which still remains the chief export, Haiti produces increasing amounts of cocoa, cotton, tobacco, and sugar. Logwood (used for dyeing) and other valuable woods are exported, and plans are being made for the development of mineral wealth.

The people, however, are still low in civilization. The women do most of the manual labor, and all are ignorant and lazy. Although they are nominally Roman Catholics, the barbaric rites of Voodoo worship, a survival of African fetishism, still flourish in many parts. French is spoken throughout the republic, generally in an impure form called "creole." Area, 10,200 square miles. Population, estimated at about 2,500,000.

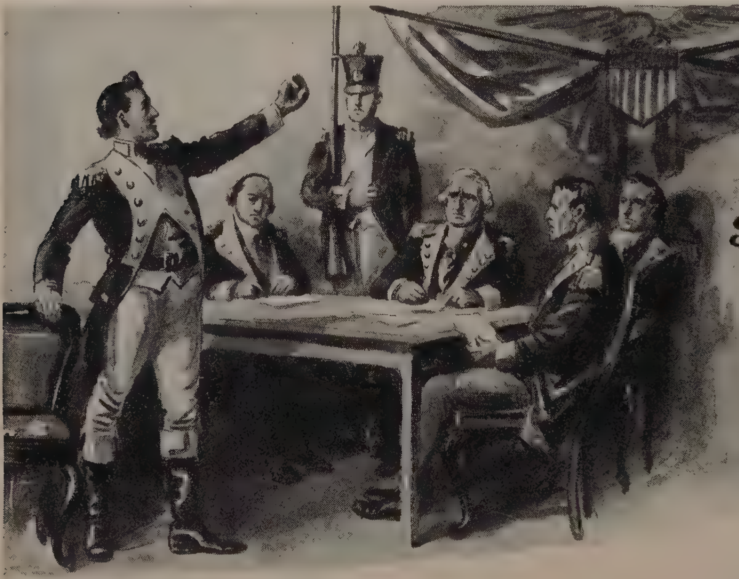
The history of the island has been a turbulent one ever since its discovery by Columbus, in 1492, when he named it "Hispaniola," or "Little Spain." Negro slaves were brought in after the extermination of the Indians, Spanish rule gave way to French, and native revolutions vied with pirates in maintaining constant disorder. In 1791 the blacks determined to abolish their masters, and under Toussaint L'Ouverture and his successor, Dessalines, the French were driven from the island. Since 1804, when the republic was organized, its history has been one of constant war, oppression, and revolution. Every president has been of the negro race, and many of them attempted to establish military despotisms. Of the first 36 presidents 15 were deposed by revolutions, 13 fled into exile, and 3 were assassinated.

HALE, EDWARD EVERETT (1822–1909). "If all the little children who have sat on Dr. Hale's knee were started in a procession four abreast from the State House steps, there would be a line of merry faces across the Common, out to the Public Library, over Harvard Bridge, and away beyond to remoter landmarks." These words, better than a record of all he did as preacher, social worker, and writer, help us to understand why Edward Everett Hale for two generations was not only esteemed but loved by the people of his native Boston as well as by all Americans who came to know him or his work.

After graduating from Harvard and studying theology, he entered the Unitarian ministry, becoming pastor of the Church of the Unity in Worcester, Mass., and later of the South Congregational Society, a Unitarian church in Boston. He was a leader not only in religious affairs, but in social and benevolent movements of many kinds. Societies such as the Lend-a-Hand Clubs, Look-Up Legions, King's Daughters, and King's Sons owe their beginnings to his inspiration, having as their motto his words: "Look up and not down; look forward and not back; look out and not in; and lend a hand."

To the country in general Dr. Hale is best known as the author of that "parable of patriotism," as it has been called, 'The Man Without a Country'. So real did this story seem that many thought it was a record of actual fact, until the author himself stated that it was his own invention. Fiction as it is, it is true in the highest sense, for since the time of the Civil War, when it was written it has been the means of instilling real love of country into the hearts of countless Americans. In the midst of many activities, Dr. Hale found time to edit religious and other journals, and to write or edit more than 60 books covering a wide range of subjects—fiction, travel, biography, history, and sermons.

Among his best-known works are: 'My Double and How He Undid Me' (1859); 'The Man Without a Country' (1863); 'Ten Times One is Ten' (1870); 'His Level Best, and Other Stories' (1872); 'In His Name' (1873); 'Philip Nolan's Friends' (1876); 'Boys' Heroes' (1886); 'Lowell and His Friends' (1899); 'Memories of a Hundred Years' (1900).



The Story of "The MAN WITHOUT A COUNTRY"

IN a square log-built room at Fort Adams, on the Mississippi River, in the year 1805—according to our story—a court-martial was held. A number of officers of varying rank were being tried in connection with the conspiracy of Aaron Burr. Among those who were brought before old Colonel Morgan, who acted as president of the court, was a young lieutenant, straight, tall, white-lipped, and defiant. As there was plenty of evidence against him, he was proved guilty.

"Do you wish to say anything to show that you have always been faithful to the United States?" Colonel Morgan asked him at the close of the trial.

His head flung back, his hands clenched, all the fire of his Southern blood released in one moment of blind madness, Philip Nolan cried out:

"Damn the United States. I wish I may never hear of the United States again."

The words came like a personal insult to that veteran of the Revolution, the white-haired Colonel. A silence fell on the court. When Morgan finally spoke, it was through lips as white as those of the offender.

"Prisoner, hear the sentence of the Court. The Court decides that you never hear the name of the United States again."

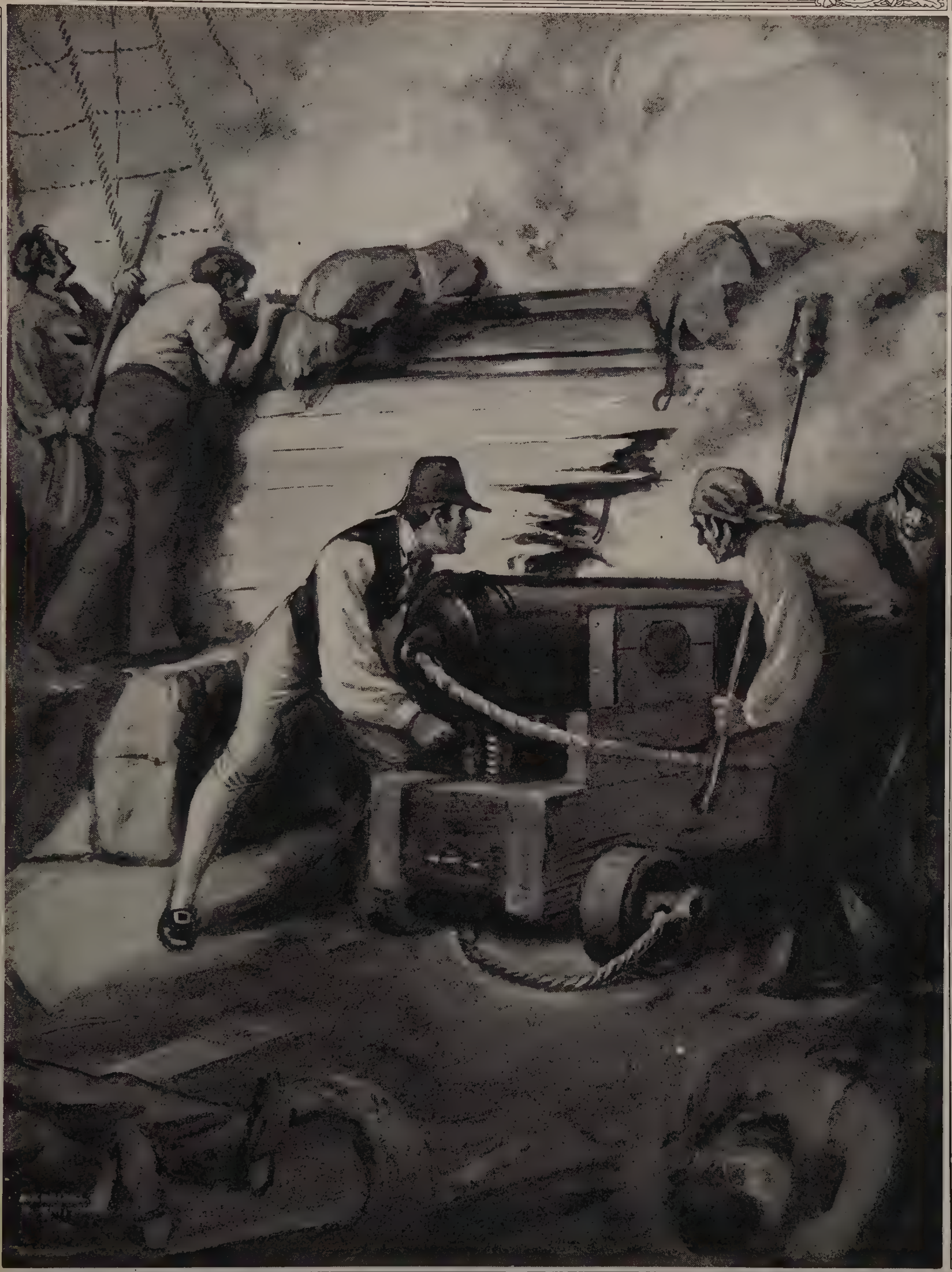
Nolan laughed. But his mirth ended abruptly, for no one else laughed.

"Mr. Marshal," continued the Colonel, "take the prisoner to New Orleans in an armed boat and deliver him to the naval commander there. See that no one mentions the United States to the prisoner. You will receive written orders from the officer on duty this evening."

The Beginning of His Punishment

Nolan, "the man without a country," was put on board a government vessel bound on a long cruise. The plan then put into effect was carried out through

WHEN NOLAN PROVED HE LOVED HIS COUNTRY



Aften seven years, during which Nolan was not allowed to see the United States or hear its name, he found himself on board a small American ship. Although he did not know it, the War of 1812 was being fought, and Nolan suddenly found himself in the midst of a naval engagement. All his suppressed patriotism came to the front, and he leaped to take command of a gun crew whose leader had been killed. "Fire, boys, we can't let them beat us!" he called, and served his gun the best of any on board ship.

his life. He was never allowed to touch land except in a foreign port, he was transferred from ship to ship as each came near the end of its homeward voyage. He was allowed every privilege of a first-class passenger—was given books to read, and he could write or otherwise occupy himself as he chose. He was permitted to talk freely with naval officers, but speech with the sailors was forbidden him unless an officer were present. All reading matter was carefully looked over before it was put into his hands, and references to the United States or to any of its affairs were carefully removed. He chose to wear the uniform of a lieutenant in the army, but the buttons which bore the insignia of his disowned country were removed, and plain ones put in their place. For this reason he was often called "Plain Buttons."

When a ship was in southern waters it was the habit of the officers and passengers to sit on deck in the warm lazy afternoons and read aloud.

Nolan had a pleasant voice and read well. His turn to read, therefore, was usually greeted with contented smiles. On one particular afternoon one of the younger officers had brought a copy of Walter Scott's recently published 'Lay of the Last Minstrel'. No one knew a line of the poem, but it was thought that, since it was a tale of the Scottish Border of two hundred years before, it was safe as far as Nolan was concerned. As he read he came to the famous lines on patriotism:

> Breathes there a man with soul so dead
> Who never to himself hath said,
>   This is my own, my native land!

Nolan stopped short, turned a little white, but swallowed and went on—

> Whose heart hath ne'er within him burn'd
> As home his footsteps he hath turn'd
>   From wandering on a foreign strand?

Here he choked, rose, and flinging the book into the sea, went into his cabin. He did not come out again for nearly two months. When at last he did emerge from his self-imposed confinement, he was a different man. He had lost his old swagger, and never read aloud again except from the Bible or Shakespeare. He spoke seldom, and then to very few people. His punishment was just beginning.

Gallant Action in the War of 1812

In the War of 1812 between the English and the Americans, Nolan did a very fine thing. He had then served seven years of his strange sentence, and was on one of the small men-of-war which the navy of that time boasted.

An English frigate opened fire, hitting the port of the American ship, killing the officer of a gun crew and several of the men. Then suddenly Nolan stepped forward.

"Fire, boys, we can't let them beat us," he called in a voice that put courage into the hearts of the fearful, and cheered those who had lost hope. He took full charge, loading the gun, showing the men how to handle heavy shot, sitting on the gun while it cooled, although this exposed him to the heavy fire of the enemy, and getting it reloaded oftener than any other gun on board.

When the skirmish was over and the English commander had surrendered, the commodore said:

"Where is Mr. Nolan? Ask Mr. Nolan to come here." When he appeared, "Mr. Nolan," said the commodore, "we are all grateful to you today; you are one of us; you will be named in the dispatches." And taking off his own sword of ceremony he presented it to the prisoner. Nolan was so happy he wept like a child.

Nolan *was* named in the dispatches, and it is believed that the commodore asked that he might be pardoned, but the State Department ignored the request; as they ignored any reference to him or any question about him.

Nolan and the Liberated Slaves

It was some eight years later that Nolan met with a situation which seemed the hardest that he had to bear. The boat upon which he was then voyaging came across a small schooner that had slaves on board. It was, at this time, against the law to bring any more slaves into the country, and so an officer from the American ship was sent to take charge. He was soon back, asking if anyone among the crew or passengers could speak Portuguese. Nolan offered his services.

When he boarded the dirty little schooner, he told the poor, bewildered negroes that they were free. They fell at his feet, kissed his hands, and cried out to him in broken voices:

"Tell them to take us home, take us to our own country, to our own houses, to our own babies and wives. We have not seen our home or heard of them in six months. Tell them to take us to Africa, our native land."

As Nolan told the American officer faithfully, word for word, he broke out in cold perspiration, and his face became gray. But he stuck to his post until he had interpreted to them what the white officer said, "Tell them yes, yes, yes; tell them they shall go to the moon if they will. If I have to sail this schooner through the desert, they shall go home."

Nolan could stand it no longer. His voice was silent, his throat dry and his eyes hot with suppressed tears. These poor African savages could go home, but he could not. He returned to his own ship and did not come out of his cabin for days.

He must have been nearly 80 when he died, a gentle, sad-eyed old man, who kept to himself a good deal, and whose face bore the marks of his punishment more plainly than if they had been cut in with a lash.

As he lay, knowing that he must die, he called into his cabin one of the men with whom he had formed some degree of friendship. To the man who entered it for the first time, the room was strange and startling. Above a crude picture of Washington, which Nolan had drawn, the Stars and Stripes were traced, with a great eagle poised over them. At the foot of his berth was a map of the United States as it was in 1805, beautifully drawn from memory. He had, of course, heard nothing of the progress of events during the time of his imprisonment, and the states admitted after that date were missing.

"Danforth," he said, "I am dying. I have surely been punished enough for the sin of my youth. Please tell me everything that has happened in the United States since I left."

As well as he could, Danforth told him all he knew, the old man's eager face shining as he listened. It was a long tale, for much had happened, but it was worth the effort for the happiness it gave.

"Look in my Bible when I am gone," Nolan said, when he had thanked Danforth again and again.

That night he died, and in his Bible they found this message, "Bury me in the sea; it has been my home, and I love it. But will not someone set up a stone to my memory at Fort Adams or New Orleans, that my disgrace may not be more than I ought to bear? Say on it:

In Memory of
PHILIP NOLAN
Lieutenant of the Army of the United States.
He loved his country as no other man has loved her; but no man deserved less at her hands.

—*Retold from Edward Everett Hale's 'The Man Without a Country'.*

HALE, NATHAN (1755–1776). In the dark days of 1776 after the retreat of the American army from Long Island, General Washington called for a volunteer to enter the British lines to secure information of the enemy. A young student of Yale College, 21 years of age, answered the call, and by so doing the patriot, Captain Nathan Hale, became a spy. His brother officers tried to dissuade him from the dangerous undertaking, but he felt that any service which his country needed was honorable.

He set out for the British lines in the disguise of a Dutch schoolmaster. He secured the information needed, and was on his way back to the American camp when he was detected, and arrested on Sept. 21, 1776. The papers in his shoes, as well as his own testimony, convicted him, and in accordance with military law General Howe ordered him to be hanged as a spy. The next morning the sentence was carried out, probably near the spot where a statue of him now stands in New York City. His last words are said to have been, "I only regret that I have but one life to lose for my country."

HALIBUT. The largest of the flatfish and the most important as a food supply. It is found in cold ocean waters and is caught by the same methods as the cod. Specimens five feet in length and 100 pounds in weight are frequently seen in the markets, and some halibut reach a length of ten feet or more. The halibut fisheries on the North Atlantic coast are rapidly being depleted and the chief supply for the United States is now brought by fast express trains from the Pacific. The name is derived from "holy" and recalls the halibut's use for food on holy days. (*See* Fish; Flatfish).

HALIFAX, NOVA SCOTIA. The poet Kipling gave the name "The Warden of the North" to Halifax, the capital of Nova Scotia, because it is the greatest fortress and chief naval station of the British Empire in North America. It has occupied this position almost from the date of its founding by the British in 1749. When the English troops were driven out of Boston, in the first year of the American Revolution, they sailed away to Halifax to reorganize for the struggle. In the War of 1812 it was the base for the operations of British privateers, and during the American Civil War it became an important base for the Confederate blockade-runners. Many troops of

OVERLOOKING THE WATERFRONT OF HALIFAX

This view, taken from the roadway leading down from the citadel, gives a good idea of Halifax's wonderful harbor. About a mile wide and sixteen miles long, it has ample room and is well protected from storms. Twenty to thirty minutes' steaming takes a vessel from dock to the open sea. It was in this harbor that a French ammunition ship blew up in 1917, killing 2,000 persons.

both the United States and Canada sailed from Halifax during the World War of 1914–1918. On Dec. 6, 1917, a French vessel carrying a large cargo of munitions collided with a Belgian relief ship in the harbor, causing a terrible explosion and fire which killed 2,000 persons and devastated an area of about 2½ square miles on the north side of the city.

One reason why Halifax was so important during the war is that it is 600 miles, or about one day's steaming, nearer to England than the port of New York. It is also nearer to some ports of South America, and to South Africa, than several other northern ports of North America.

Its favorable position and its magnificent harbor make Halifax a great commercial center. Because of this the Canadian government has spent $30,000,000 improving the shipping facilities. It has built huge terminals where transcontinental trains can run alongside the great Atlantic liners.

Manufactures of importance have also grown up. Raw sugar is brought in from the West Indies and is refined in the largest refinery in Canada, an extensive oil refinery has been established, and foundries and machine shops make and repair equipment used by the great transportation companies. Population, about 60,000.

HALL OF FAME. On University Heights in New York City, on the grounds of the New York University, overlooking the Hudson River, is the "Hall of Fame for Great Americans." A colonnade 500 feet in length contains panels for 150 bronze tablets, each to bear the name of the person commemorated, the dates of his birth and death, and an appropriate inscription.

According to the conditions established by Helen Gould, the donor of the memorial, only persons who have been dead ten years or more may be so honored. Fifty names were to be inscribed at the beginning in 1900, and five names added every fifth year thereafter, until the full number is completed. Nominations made by the general public are received by the University senate, and those seconded by them are submitted to a committee of 100 prominent citizens, who vote upon them. All elections are subject to the approval of the University senate. If the full number of names is not chosen, the vacancies may be filled at the following election. In addition to statesmen, authors, artists, scientists, and educators, the 15 classes of citizens recommended for consideration include business men, inventors, engineers, explorers, philanthropists, and the like. A proposal of a separate hall for foreign-born Americans (later abandoned), and one for a Hall of Fame for Women, created some confusion in the voting. Only 29 instead of 50 names were offered in the first selection. These with later additions are given in the accompanying list.

GREAT AMERICANS ELECTED TO THE HALL OF FAME

CHOSEN IN 1900

George Washington
Abraham Lincoln
Daniel Webster
Benjamin Franklin
Ulysses S. Grant
John Marshall
Thomas Jefferson
Ralph Waldo Emerson
Henry Wadsworth Longfellow
Robert Fulton
Washington Irving
Jonathan Edwards
Samuel F. B. Morse
David Glasgow Farragut
Henry Clay
Nathaniel Hawthorne
George Peabody
Robert E. Lee
Peter Cooper
Eli Whitney
John James Audubon
Horace Mann
Henry Ward Beecher
James Kent
Joseph Story
John Adams
William Ellery Channing
Gilbert Stuart
Asa Gray

NAMES SUBSEQUENTLY ADDED

James Russell Lowell
John Greenleaf Whittier
John Quincy Adams
James Madison
Alexander Hamilton
William T. Sherman
Louis Agassiz
Maria Mitchell
Emma Willard
Mary Lyon
Harriet Beecher Stowe
Oliver Wendell Holmes
Edgar Allen Poe
James Fenimore Cooper
Phillips Brooks
William Cullen Bryant
Frances E. Willard
George Bancroft
John Lothrop Motley
Mark Hopkins
Francis Parkman
Elias Howe
Joseph Henry
Charlotte Cushman
Rufus Choate
Daniel Boone
Samuel L. Clemens (Mark Twain)
Augustus St. Gaudens
James Buchanan Eads
Patrick Henry
William T. G. Morton
Roger Williams
Alice Freeman Palmer
Andrew Jackson

HALLOWE'EN. Strange things may happen to one on Hallowe'en, so superstitious folk used to believe; for they thought that witches then rode abroad on broomsticks, elves played pranks on sober folk, and the future might be foretold by jumping over a lighted candle, or by any one of a hundred other magic rites.

Many of these strange superstitions have come down to us from our pagan ancestors of 2,000 years ago and more, for our Hallowe'en occurs about the time of the ancient Druidic autumn festival. This was also the season of the ancient Roman festival in honor of Pomona, the goddess of fruit and gardens; and so, after the Roman conquest of Gaul and Britain, some of the Roman beliefs and ceremonies were added. Later, after the spread of Christianity, November 1 was made a day for the honoring of all the saints, and the eve of that day was called "Hallowe'en" (or "All Hallow-Even"), meaning the "holy eve" of All Saints' Day. Many of the old pagan customs were retained, and so we still crack nuts, and bob for apples, and throw apple peelings over our shoulders, and look in a mirror by candle light in a darkened room, as our pagan ancestors did centuries ago.

HALS (*häls*), **FRANS** (1580?–1666). One of the amazing chapters in the history of art is that which tells how this Dutch painter, who is now recognized as one of the greatest portrait painters of all time, was almost forgotten and his work ignored for two centuries after his death. So slightly was he esteemed that some of his paintings were sold for a few dollars, though of late years as much as $125,000 has been paid for a single work by him. Critics today unite in putting him next to Rembrandt at the head of the Dutch school, and some even call him the greatest of all painters for truth of character.

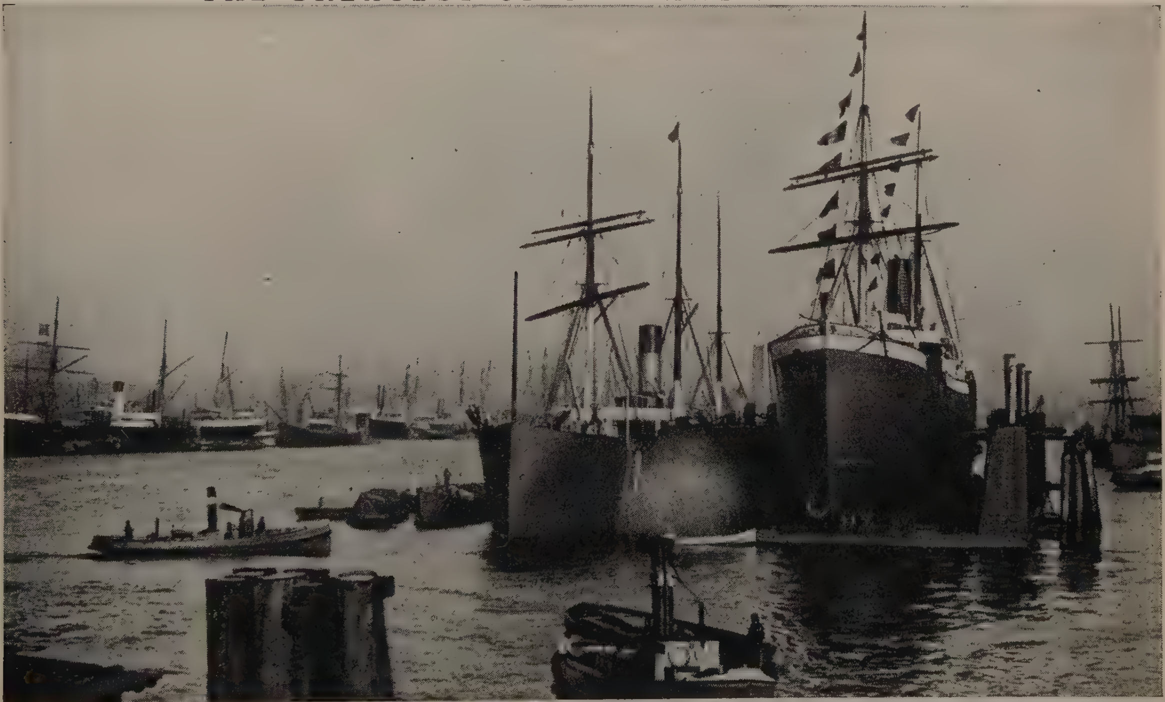
Frans Hals had a checkered life, marked by the same bold contrasts of light and shade that are found in his work. Though of an ancient patrician family, the equal of the sturdy Haarlem burghers whose portraits he painted so profusely, Hals found the rollicking life of tavern and street more to his taste. Singers and jesters, pot-girls and tavern heroes—these were his favorite subjects; and he set them down on canvas with such an unquenchable humor and joy of living and so masterly a hand that no one can look at them without a responsive smile. But the painter's love of tavern life reduced him to penury, and near the close of his long life we find him so poor that he had to apply to the municipality for alms.

Born in Antwerp, Hals moved to Haarlem in Holland when he was a young man. In 1616 he began the first of the great series of shooting-guild groups and public officials that show his genius particularly well. In the Town Hall of Haarlem 84 ladies and gentlemen look down from the walls in eight great canvases. The last of the series was painted in 1661, when Hals was 81. There on the walls may be traced the artist's development. The picture painted in 1633 shows him at his most vigorous period, when his brilliant color and quick grasp of fleeting expression were at their height. The later groups are painted with great skill but the coloring has been toned down to somber gray tints. Does the grayness of these last pictures reflect the sadness of the poverty-stricken painter's declining years? Some hold to this explanation; others say that bright colors were so expensive that he had to use the cheaper black and white after his days of plenty were over.

Many other examples of Hals's work are scattered throughout the world in public and private galleries. 'The Fool', a copy of which hangs in the Rijks Museum in Amsterdam, is considered by many to be the best character portrait ever painted. 'Hille Bobbe', an old woman with a half-witted grin, may be seen in the Royal Museum in Berlin. His best-known work is 'The Laughing Cavalier' in the Wallace Collection in London. The original owner paid $400 for it. Sir Richard Wallace paid $10,200 for it in 1865, and since then its value has increased greatly.

HAMBURG, GERMANY. Before the World War, Hamburg was the second largest city in Germany and the third largest seaport in the world, and presented a picturesque combination of life on land and water. Lying on the north bank of the Elbe River, 75 miles from its mouth, Hamburg bestrides a little stream called the Alster, which is here dammed, forming two lakes as harbors in the heart of the city. The older part of the town to the east is intersected by a great number of narrow canals, lined with warehouses and squat dwellings that seem to rise right out of the water. Barges and skiffs loaded with merchandise ply up and down these canals, and people may go and come from home to business in pleasant little

THE GREATEST OF GERMANY'S SEAPORTS



We are looking across the Elbe River at Hamburg, during the days before the World War, when this was not only the largest German seaport, but the third most important harbor in the world. Although Hamburg is 75 miles from the sea, the largest vessels can come to dock here. The waterfront is six miles long, and is equipped with all the conveniences for loading, unloading and repairing vessels. Here, for instance, we see one of the many floating dry docks lifting a vessel bodily out of the water.

steamers. Great sea-going vessels can come at high tide to the heart of the city and unload their cargoes into barges that distribute them as far inland as Prague in Bohemia. (*See* Elbe River).

Hamburg is a "city-state" with a republican form of government and a place in the German republic alongside of Bavaria, Saxony, and Prussia. The territory under its rule covers an area of about 160 square miles, including the outlying port of Cuxhaven at the mouth of the Elbe, with its tremendous system of docks and quays.

Viewed from the left bank of the Elbe, Hamburg and the adjoining Prussian town of Altona look like one city. With a continuous river frontage of six miles, crowded with shipping in normal times, and with its densely packed houses in the background surmounted by lofty church spires, the city gives an impression of massive grandeur. On the borders of the Binnen Alster, the smaller of the two lakes, are grouped fashionable avenues and the more important business streets, lined with magnificent buildings.

In the Hopfenmarkt, one of the largest public squares, stands the church of St. Nicholas (Nikolaikirche). Built as a memorial of the fire of 1842, it is the third highest religious edifice in the world, its spire soaring 483 feet above the street level. The new Rathaus is the most important of the secular buildings. The hospital at Eppendorf is one of the finest in Europe. Hagenbeck's private zoölogical gardens, which formerly contained the largest and most complete collection of wild animals in captivity, are also noted for life-size models of prehistoric monsters. The site of the city's old ramparts and fortifications has been converted into gardens and promenades of extraordinary beauty.

The History of Hamburg

Hamburg has its origin in a fortress and bishopric founded here by Charlemagne in 808–811. Its importance as a center of commerce began in the 12th century when Emperor Frederick I granted it free navigation of the Elbe, with the right of levying toll on foreign shipping. In 1241, it joined in the formation of the Hanseatic League and became the seat of its upper court (*see* Hanseatic League). This gave a tremendous impetus to its rapidly increasing wealth and commercial importance. In 1510 Maximilian I reorganized Hamburg as a free imperial city. Through its vigorous administration Hamburg suffered little from the Thirty Years' War, so fatal to other parts of Germany. Under Napoleon the French occupied it from 1806 to 1814.

Hamburg's modern greatness came in the middle of the 19th century with the development of great steamer lines to all parts of the world. Lying on the western side of the Danish peninsula, with an ice-free harbor all the year, it shared with Bremen the north Atlantic trade. A great part of its population, before the World War of 1914–18 paralyzed its industrial life, was engaged in shipping, shipbuilding, and allied occupations.

A great fire in 1842 destroyed one-third of Hamburg within three days; but this proved almost a blessing, since it resulted in a new city of wider streets and modern structures, a veritable Phoenix that rose from the ashes, statelier and more beautiful than ever. Area of the city-state, 160 square miles; population, about 1,200,000.

HAMILTON, ALEXANDER (1757–1804). Of all the men who aided in founding the republic of the United States, and in framing and setting up the government under the Constitution, the most brilliant was Alexander Hamilton. In spite of his youth (he was not yet 20 when the war began) he was one of Washington's most trusted aids in the Revolution; as a lawyer he ranked among the foremost of his time; in the critical period of 1783–89 he won recognition as one of the soundest political thinkers of the day; and in setting up the new Federal government he had the chief part in translating the lifeless provisions of the Constitution into a strong, national governing system. It is not too much to call him the greatest constructive statesman in United States history.

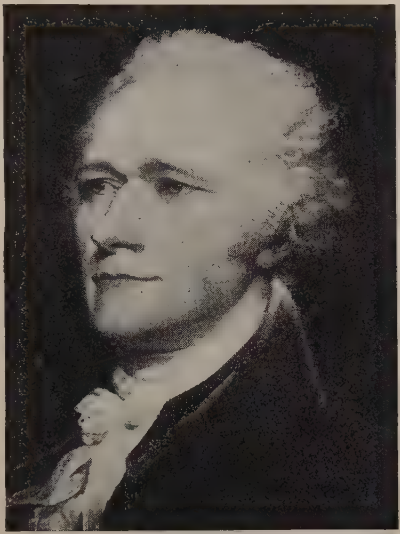
Hamilton's history was as unusual as the man himself. Born in the island of Nevis, in the British West Indies, he inherited from his well-born Scotch father shrewdness and a logical mind, while from his gentle Huguenot mother he received the liveliness and charm characteristic of the French. He early displayed a talent for writing, and his vivid description of a West Indian hurricane, which appeared in one of the local papers, so impressed his friends that they raised money and sent him to America to complete his education.

Hamilton's course at King's College (now Columbia University) in New York City was interrupted by the outbreak of the Revolutionary War. As early as 1774 he had begun to advocate the cause of the colonists; and as soon as the conflict began he entered the army, and was soon made captain. Then for four years (1777–81) he was on Washington's staff with the rank of lieutenant-colonel. He took a brilliant part in the field in the campaign which ended with Cornwallis' surrender. Washington felt for him the sincerest admiration and affection.

Even during the war Hamilton had seen the need for a strong central government; and during the critical period which followed, when the country was "floundering helplessly in a sea of unpaid debts and broken promises," he advocated the formation of a new constitution to take the place of the weak Articles of Confederation. He persuaded New York to send delegates to the Philadelphia Convention, and was himself chosen as one of the three to represent the state; but the other two were bitter Antifederalists and he was constantly outvoted until they withdrew from the convention. Then Hamilton signed the Constitution for New York. He believed that a limited monarchy like that of Great Britain was the best on earth, and failing that, he would have preferred a strong aristocratic republic, with the officers chosen for life. Nevertheless he exerted all his great powers in support of the Constitution that was formed. The opposition in his own state under Gov. George Clinton was very strong and without New York's ratification the Constitution could win no real success. So Hamilton, with the assistance of Madison and Jay, undertook to write a series of newspaper articles in its defense over the signature "The Federalist." Not only did these articles prove the decisive factor in securing New York's ratification, but they had a tremendous influence throughout the country. Although written only to serve a particular purpose in his own day, they have proved of great permanent value to students of law and political science, and are regarded as a classic commentary on the Constitution.

Washington appointed Hamilton as the first Secretary of the Treasury, and it was in this office that he left his strongest impress on the American government. It was he who at the outset gave the government under the Constitution its leaning toward strength and national unity on which Chief Justice Marshall was later able so effectively to build. His financial measures not merely assured the payment in full of the foreign and domestic debt of the United States, but also included the taking over by the United States of the debts contracted by the states as a result of the Revolution. The provision he carried through Congress only by a bargain which gave to the South the location of the Federal Capital on the Potomac. But the effect of the measure was not merely to restore the credit of the country, but to bind to the Union every holder of state and national "script" or bonds. Other important measures included the establishing of a national bank and the enacting of a tariff which should "protect infant industries." No American statesman ever had greater tasks to face than had Hamilton, and none was more successful in meeting them.

ALEXANDER HAMILTON



"The Greatest Constructive Statesman in United States history."

In his efforts to strengthen the national government Hamilton was opposed by Jefferson, Washington's Secretary of State, who was a firm believer in state's rights, and opposing views as to struggling France and England widened the breach. The two became the leaders of the first organized political parties of the United States—the Federalists and the Democratic Republicans (*see* Political Parties). Jefferson resigned from office at the close of 1793, and Hamilton a year later, but their party antagonism continued. In the election of 1800 Jefferson's party swept the country, but owing to a tangle of the election laws Congress was called upon to decide whether Jefferson or Aaron Burr should be president. Hamilton used his influence to defeat a plan of less scrupulous Federalists to substitute the vice-presidential for the presidential candidate of their opponents. Hamilton knew that the voters meant Jefferson to be their chief executive, and besides he profoundly distrusted Burr.

As a result of Hamilton's persistent opposition to him Burr finally challenged Hamilton to a duel. According to the accepted code of honor in his day, Hamilton could not refuse the challenge. On the morning of July 11, 1804, they met at Weehawken, a noted duelling-ground on the Jersey shore of the Hudson, opposite New York City. Hamilton did not intend to fire, but his opponent aimed with deadly precision. Hamilton fell mortally wounded, and died the next day. He was generally mourned by his countrymen; even those who differed from him politically were compelled to respect his great abilities and patriotism, and his untimely death was looked upon as a great public calamity.

HAMILTON, ONTARIO. Its location on an excellent harbor at the western end of Lake Ontario, and the cheap electrical power obtained from Niagara Falls, and the smaller Decew Falls, have combined to make Hamilton one of the foremost manufacturing cities of Canada. It has about 500 factories, which produce steel, iron, cotton and woolen goods, farm machinery, electrical supplies, stoves, furniture, and many other articles. Among the chief establishments are the Canadian plants of the International Harvester, Westinghouse, International Steel, and Oliver Plow companies. Hamilton is also the shipping center for the rich Ontario fruit district. Natural gas is obtained from the nearby Welland fields.

Hamilton is an attractive city, with its broad tree-bordered streets lined with residences and fine public buildings, which extend from the bay up the slope of "the Mountain," a continuation of the ridge over which the Niagara River flows to make Niagara Falls. Population, about 115,000.

'HAMLET'. By almost universal consent this is regarded as Shakespeare's greatest tragedy. The opening of the play reveals Hamlet, the young prince of Denmark, plunged in bitter grief by the sudden taking off of his royal father, who according to report had died of a serpent's sting. The fact that the queen, his mother, has almost immediately married the dead king's ill-favored brother adds to the Prince's sorrow. To him appears from the tomb the dread spirit of his father, revealing that, "sleeping, by a brother's hand" he had been put to death; and calls upon Hamlet to revenge this "foul and most unnatural murder."

Hamlet's brilliant, sensitive mind is thrown into feverish activity by the horror of this deed, yet he would make sure of his uncle's guilt. He feigns insanity, the better to watch the guilty pair, and in a court play has the actors insert a scene like that of his father's murder, that he may observe its effect on the usurping king. The latter's confusion confirms the ghost's revelation; but Hamlet, distracted between his duty of revenge and his inability to form a plan, contemplates his own suicide. "To be or not to be"—to live or die—he muses bitterly, "that is the question"—

> Whether 'tis nobler in the mind to suffer
> The slings and arrows of outrageous fortune;
> Or to take arms against a sea of troubles,
> And, by opposing, end them? To die: to sleep;
> No more; and, by a sleep to say we end
> The heartache, and the thousand natural shocks
> That flesh is heir to, 'tis a consummation
> Devoutly to be wished. To die, to sleep;
> To sleep: perchance to dream: ay, there's the rub;
> For in that sleep of death what dreams may come
> When we have shuffled off this mortal coil,
> Must give us pause. There's the respect
> That makes calamity of so long life;
> For who would bear the whips and scorns of time,
> The oppressor's wrong, the proud man's contumely,
> The pangs of despised love, the law's delay,
> The insolence of office, and the spurns
> That patient merit of the unworthy takes,
> When he himself might his quietus make
> With a bare bodkin? Who would fardels bear,
> To grunt and sweat under a weary life,
> But that the dread of something after death,
> The undiscovered country from whose bourn
> No traveller returns, puzzles the will,
> And makes us rather bear those ills we have
> Than fly to others we know not of?
> Thus conscience does make cowards of us all;
> And thus the native hue of resolution
> Is sicklied o'er with the pale cast of thought,
> And enterprises of great pith and moment
> With this regard their currents turn awry,
> And lose the name of action.

While Hamlet thus postpones revenge, the king resolves on Hamlet's instant death. Before he can effect it, Hamlet by accident has slain old Lord Polonius; whereupon the daughter of Polonius, Ophelia, a gentle girl with whom Hamlet is much in love, goes insane and drowns herself. Polonius' son, Laertes, swears hot revenge, and is thereupon ensnared by the king to carry out his own designs. A duelling match is planned with Hamlet, wherein Laertes, by the King's advice, shall use an untipped foil, poisoned at the point, while the king will furnish a cup of poisoned drink to quench Hamlet's thirst. In this tragic duel and end of the play, Hamlet is indeed slain as planned, but in the scuffle Laertes himself is pierced with his own envenomed sword. The queen by mistake drinks the poisoned cup and dies, and Hamlet in the instant of his death stabs the wicked king. About the only comic relief to the play is the dialogue of the grave-diggers who dig the grave of "the fair Ophelia."

HAMPDEN, JOHN (1594–1643). "Patriot" Hampden lives in history as one of the most gallant and determined of the band of Puritan statesmen who opposed the autocratic government of Charles I and brought on the English Civil War. He was a man of wealth and position, a cousin to Oliver Cromwell, and one of that leader's ablest supporters and advisers.

By refusing to pay the illegal ship-money tax levied by the king, Hampden became a popular hero and a central figure in the early stages of the Puritan Revolution. At his trial in 1637 seven of the 12 judges voted against him, but public opinion was in his favor and the opposition to the government was immeasurably strengthened. In the early days of the memorable Long Parliament (1640–60), Hampden was right-hand man to the redoubtable John Pym, then leader of the Puritan cause, and was one of the five members whose attempted seizure by King Charles on Jan. 4, 1642, lead rapidly to armed conflict.

When hostilities began, Hampden joined the parliamentary army, contributed liberally to its support, raised a regiment of infantry, and in the struggle displayed great bravery and generalship. He was mortally wounded at Chalgrove Field, June 18, 1643, and died June 24. Such was his capacity as a statesman and a soldier that the historian Macaulay has said that, if he had lived, he would have been "the Washington of England."

HANCOCK, JOHN (1737–1793). The name of this Boston patriot, written in a large bold hand, heads the list of the signers of the Declaration of Independence. From this circumstance came the common phrase, "to give one's John Hancock," meaning to sign one's name; and from it also the name of John Hancock has gained an enduring fame, which his actual importance scarcely warrants.

John Hancock did, however, play a considerable part in the events leading up to and following the Revolution. He was a wealthy Boston merchant, and in 1768 the royal commissioners of customs provoked a riot by attempting to seize his sloop, the *Liberty*, for non-payment of duties. If the government was able to collect in this case, it could also collect for previous importations, and Hancock, along with other merchants, was threatened with ruin. In part, his opposition to the Crown was no doubt due to this business interest; and it is said that, when his interest required, he violated the non-importation agreements of the colonies and imported a good deal of tea from England.

But whatever Hancock's motives may have been, from 1768 on he was active in his opposition to the British Crown. In 1770, after the "Boston Massacre," he was one of the committee that went to the governor to demand the removal of British troops from the city, and at the funeral of the victims he delivered an address which led to an order for his arrest. He was president of the revolutionary "Provincial Congress" which met at Concord and later at Cambridge, and his arrest was one of the objects of the British expedition to Concord which precipitated the battle of Lexington and Concord and began the Revolutionary War.

Hancock was elected president of the Second Continental Congress in 1775 and held that office two years. In 1780 he became the first elected governor of Massachusetts, and was annually re-elected, with an interval of two years (1785–1787), until his death. The support which he was finally induced to give to the Federal Constitution in 1788 was the decisive factor in the struggle for ratification in Massachusetts, and in setting the new plan in operation.

Despite the jealousy and vanity which limited his work, Hancock was a man of strong common sense and sound patriotism, and it meant much to the cause of the colonies to have the support of his wealth, social position, and education, when many of the upper class were Loyalists, or "Tories," as their enemies called them.

HANCOCK, WINFIELD SCOTT (1824–1886). One of the best all-round soldiers among the Union officers of the Civil War was Winfield Scott Hancock. He received his military training at West Point, graduating in 1844, and gained experience in the War with Mexico. He was a captain when the Civil War broke out, and was soon commissioned brigadier-general and helped to organize the Army of the Potomac. He did gallant service in the battles of South Mountain and Antietam (1862). At Fredericksburg (December 1862) he led his corps in a desperate attack on Maryes' Height through a deadly fire, from which less than 3,000 of the original 5,000 came back. At Gettysburg (1863) it was said that his appearance on Cemetery Ridge on the first day of the battle was equal to reinforcement by an army corps. Men who were fleeing stopped and the troops were restored to order.

General Hancock was in command of the Second Corps, and it was his forces which, on the last day of the battle, stopped the terrible charge of Pickett's men and deprived the South of all hope of victory. During this attack Hancock was seriously wounded, but he stayed on the field until the victory was won. After he recovered from his wounds, he bore an important part in the hard-fought battles of the Wilderness, Spottsylvania, and Cold Harbor, in 1864. At Spottsylvania he carried the Confederate works known as "the bloody angle," capturing 3,000 prisoners. For his notable services Hancock was promoted to the rank of major-general in 1866.

In 1880 the Democratic party made him their candidate for the presidency, but in the election he was defeated by James A. Garfield, who in addition to an honorable military career had long been a leader in Congress. Hancock remained in the army until his death, serving his country for over 40 years. He was a brave fearless leader and an able commander. McClellan called him "superb," and Grant wrote: "Hancock stands the most conspicuous figure of all who did not exercise a separate command."

HAND. Whatever men have done that distinguishes them from the brutes has been done by their brains. But the hand has been the instrument of the brain in bringing about almost all of these successes. The cultivation of the soil, mining, building, manufacturing—sculpture, painting, literature—what could man have done without his hands? Can you imagine this book to be written, printed, bound, and distributed without hands? Apart from the hand, speech is the only important instrument of the brain that distinguishes man from the lower animals.

The human hand is indeed a wonderful piece of mechanism. Placed at the end of the arm, with the ball-and-socket joint at the shoulder, the hinge joint at the elbow, and a peculiar joint at the wrist, the movements of the hand are indeed marvelous.

The eight bones of the wrist are called "carpal" bones, the five of the palm are the "metacarpals," and the 14 in the fingers are the "phalanges." These phalanges are so called because they are arranged in ranks, as were the Greek soldiers in the military formation known as the "phalanx." All these bones are bound together by tough flexible ligaments.

The muscles that move the hand are mostly upon the forearm, and have long tendons by which the pull of the muscles is communicated to the different joints. You can feel and see some of these tendons in your wrist when you bend your fingers. There are more than 30 pairs of muscles producing hand motions.

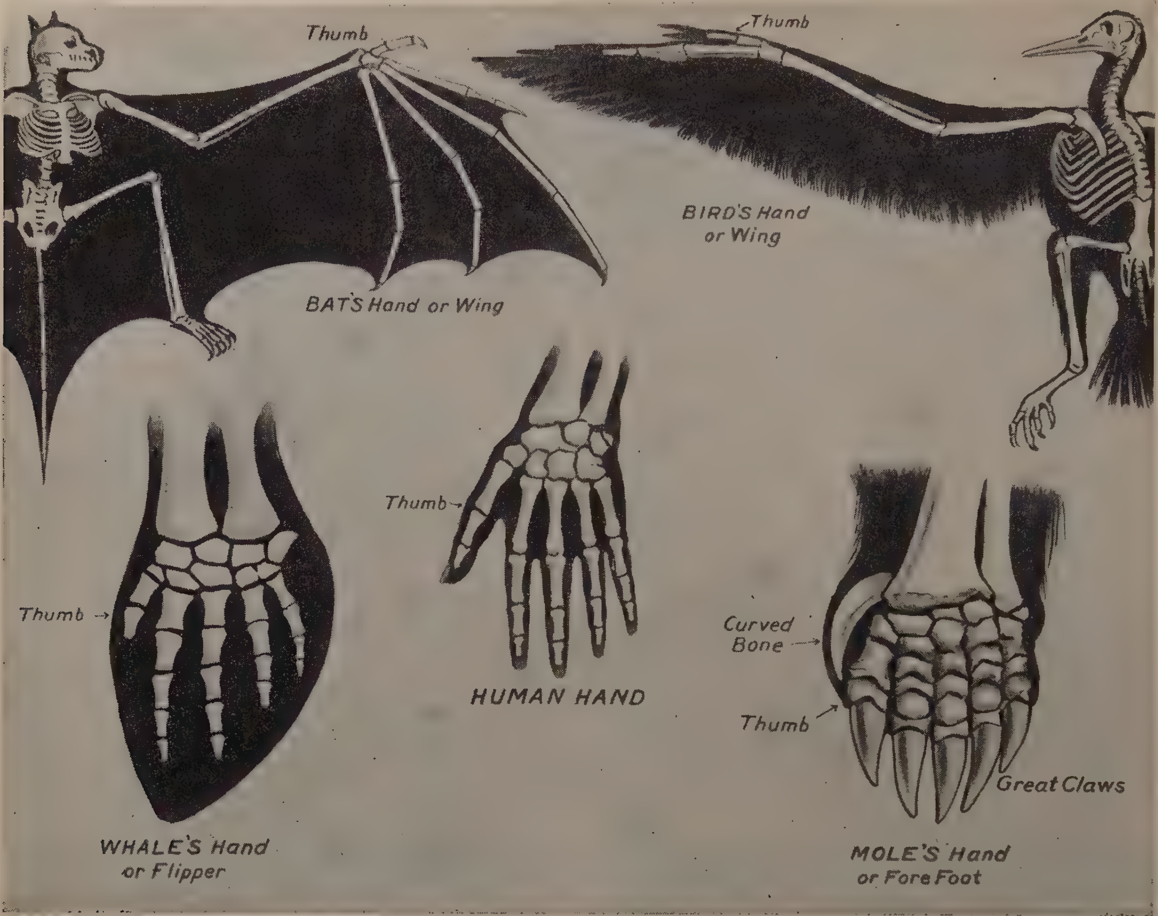
The thumb is arranged so as to work against the fingers in very useful grasping movements. Just "make believe" that you have no thumb and try to pick up something or to write or to use a fork!

The sensibility of the hand is more highly developed than in most other parts of the body. There are many little elevations or *papillae* on the skin of the palm, and fine nerve fibers extend from these to the brain. Thus the skin is made very sensitive to touch, heat, and cold.

Because it possesses both strength and lightness of touch, the hand is wonderfully adaptable to all sorts of uses. The flexible fingers can grasp large objects firmly and manipulate delicate machinery, while the nails on the tips make it possible to pick up very small things. The same hand that wields the hammer may adjust the minute parts of a watch. The lightning-like rapidity with which trained finger muscles can perform tremendously complicated tasks, such as the fingering of violin strings by a Kreisler or the rippling of piano keys by a Paderewski must always seem a miracle to the ordinary man.

While the human hand is the most completely developed in the animal kingdom for all-round purposes of protection, strength, blows, grasping, delicate movements, and sensitiveness, it is interesting to note that the fore limb of all mammals is formed on the same general plan. The horse's front hoof is just a modified finger nail; all the fingers but one have disappeared or are represented only by the remnants called "splints." In these animals the modifications

“HANDS” FOR FLYING, SWIMMING, DIGGING, AND GRASPING



While the Human hand is the most perfect instrument of all, other creatures also have “hands” adapted to various purposes. The fingers of the Bat, as you can see, have grown very long to support his wings, the “thumb” remaining free to be used as a clinging hook. The Bird's “hand” has lost almost all its fingers, stiff feathers taking their place. The Whale's hand is broad and short, but all the fingers are plainly represented. The Mole not only has the usual five digits, but also an extra bone to make his digging palm even broader, and his “finger nails” have developed into huge claws.

are for purposes of speed in running. In the bat, very long fingers are developed to support the web which, instead of feathers, constitutes the “wing” in those flying mammals. The beaver's hand has a still different form, adapted to its mode of life. The mole has a broad shovel-shaped hand. Even the whale has a fore limb which has the modified structure of a hand.

HAN'DEL, GEORGE FREDERICK (1685–1759). The name Handel suggests Christmas and the ‘Messiah’, for this oratorio of his has for so many years been given in connection with the holiday festivities that it has come to be a tradition of the season.

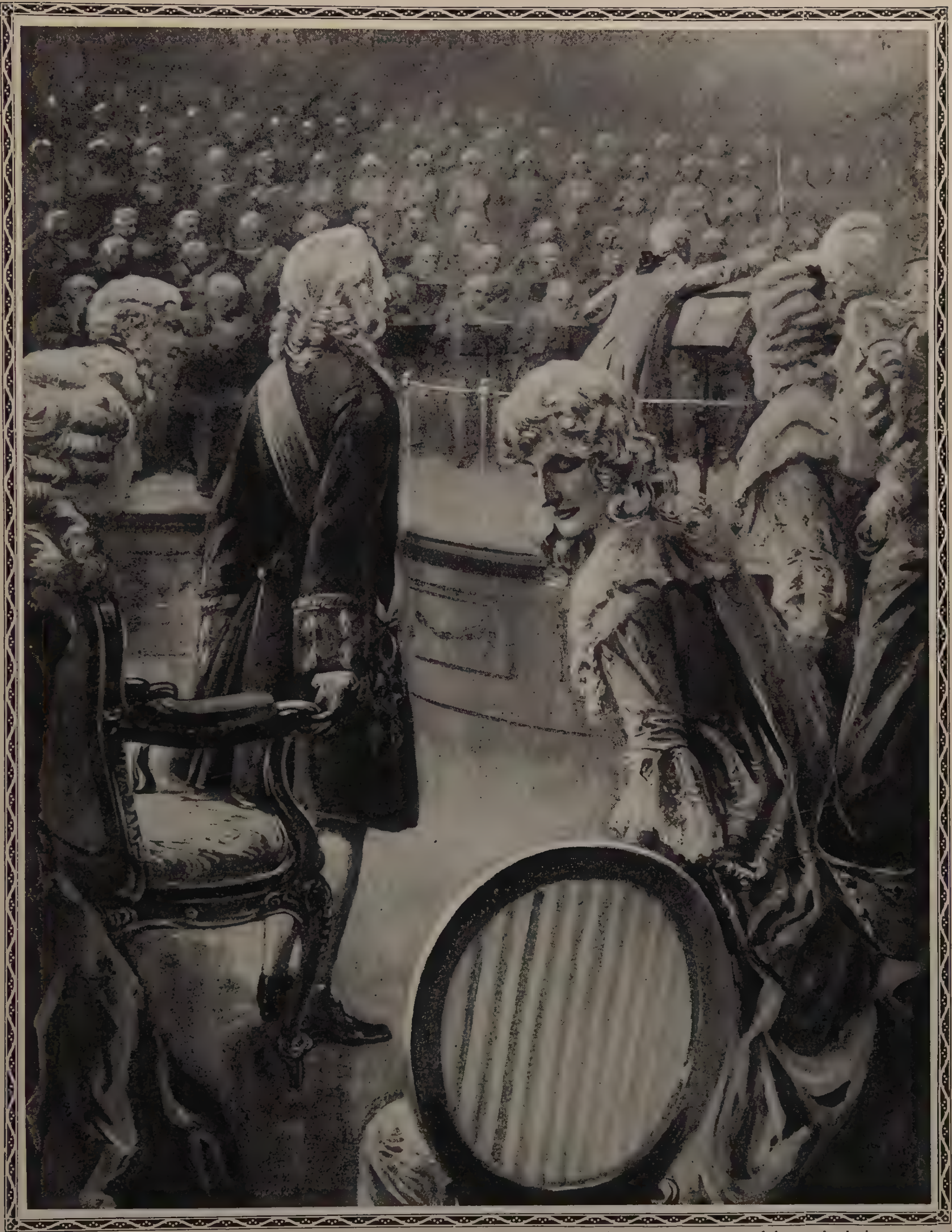
Although Handel was born a German, he won his first great fame in Italy with his Italian operas. He later became an English citizen, and is today chiefly remembered for his English oratorios.

The father of Handel, a German doctor of Halle, was much opposed to his son's musical ambitions. But the boy was obsessed with a desire to learn to play the spinet (an early form of the piano); and at the age of eight years had so taught himself that when an opportunity was presented for him to play the organ in the castle of a neighboring duke, he did it so skilfully that the duke persuaded the lad's father to give his son a musical education. The boy at once became a pupil of the organist of the Halle cathedral.

At the age of 11 he was master of the organ, clavichord, violin, and other instruments, and was proficient in musical composition. When 20 years of age he produced his first opera, which was favorably received. He went to Italy to study the Italian style of opera, and there his brilliant performances on the harpsichord won his highest recognition.

Handel next went to London, where his triumph was repeated. England offered so much in the way of opportunity and appreciation that when 41 years of age Handel became a naturalized Englishman. Seven years later he began his career as an English composer, using from that time only English texts for his oratorios. To these his greatest fame is due.

A KING'S TRIBUTE TO HANDEL'S MUSIC



Although the English public of his day had come to expect great things of Handel, none were prepared for such glorious musical effects as those obtained in his oratorio 'Messiah'. When presented by a mighty chorus and superb orchestra, the masterpiece took England by storm, and led to as graceful a tribute as has ever been given music by royalty. King George I, swept away by enthusiasm during the earlier portions of the work, rose to his feet and stood during the performance of the 'Hallelujah Chorus' and thus created the custom, which still exists, of standing during this portion of the oratorio. Handel was so impressed with the reception given his work in England that he gave up his German citizenship and became a naturalized Englishman.

Other musicians were composing operas, but English oratorio, as composed by Handel, was an innovation. The English people loved his music, and the royal family were always his staunch supporters. Handel grew old, blessed by the comfort of his music and many friends. The bitterest trial of his life came in his later years, when he became totally blind. Yet, he still played and conducted his oratorios.

Handel will never cease to be revered as one of the greatest of composers. Besides his 18 English oratorios, his works include 41 Italian operas, 2 Italian oratorios, 4 English secular oratorios, 3 volumes of English anthems, 1 volume of Latin church music, 3 volumes of Italian vocal chamber music, 37 instrumental duets and trios, and 4 volumes of orchestral music and organ concertos.

HANDWRITING. Every boy and girl is ambitious to "write a good hand" and to do this rapidly. Success in obtaining and in holding a business position often depends upon the candidate's penmanship. Hence these suggestions in regard to handwriting should be carefully considered.

Learning to write is an example of the development of manual skill, and the general principles of this sort of learning apply to it. The most important principle is repetition. We learn to make a new movement by the "trial and error," or the "cut and try," method. Nobody can tell the beginner just how to do it; he has to learn for himself. Furthermore, he cannot learn for himself by thinking it over and theorizing about how it should be done. He must try over and over again, each time trying to do it a little better.

Mere repetition, as is implied in the last sentence, is of no use. One may write a great deal and still write continually worse. The pupil, while he is practicing, must continually observe his writing closely, compare it with former specimens of his writing, and with a model which is superior to his own.

In practice a balanced emphasis should be placed on the two aspects of speed and quality. Both speed and quality should be moderate in the beginning, and should improve together. Over-emphasis on speed produces a scrawl, and over-emphasis on quality or form produces labored writing, which is apt not to be so good, even in form, as more fluent writing. As practice is prolonged, the writing becomes automatic. It may be carried on while the attention is chiefly occupied with something else. Writing should not become automatic before the quality is sufficiently good, nor should automatization be put off after this point has been reached.

The kind of drill in writing should be carefully adapted to the age and maturity of the learner. It is well for the beginner to write for several months on the blackboard alone. The large free movement of the whole arm at the board is much easier to control than the more delicate movement of the pen or pencil. When the child first writes on paper he should use a soft smooth pencil, and should write a coarse hand on large sheets of comparatively rough paper. The pen may be introduced in the third grade. Intensive drill on minute details of form should be deferred until the fourth grade or above.

The ease and quality of writing depends a good deal on position. The writer should face the desk squarely and rest both arms on it lightly for about three-quarters of their length. The paper should be directly in front of the writer, with the top tilted about 30 degrees to the left. The pen should be grasped lightly, and the hand held with the palm pretty well down and sliding easily on the nails or the first joints of the last two fingers. The writing should be carried on with a free, easy, rhythmical movement, which may be developed with the aid of counting. It is important that the hand move freely to the right while the letters are being formed.

The very strongly left-handed writer should not be forced to use his right hand. For him the position of the paper should be reversed, and he may be allowed to write back-hand.

HANG'CHOW, CHINA. When Marco Polo, the greatest of medieval travelers, visited Hangchow near the end of the 13th century, he was so transported with the number and splendor of its mansions and the wealth and luxury of its people that he declared it was the finest and noblest city in the world. It still ranks as one of the richest cities of China, though it lost much of its ancient magnificence when it was laid in ruins by the Taiping rebels in 1861. Its shops are noted for their size and the excellence of their stocks, and its manufactures of silk, paper fans, tapestries, ivory carvings, and lacquered ware are world famous.

Hangchow, which is about 100 miles southwest of Shanghai, lies near the head of the estuary of the Tsien-tang River, 50 miles from the ocean. Although the river is visited at certain seasons by destructive "bores"—great tidal waves 15 feet high which rush up-stream at the rate of 15 miles an hour—it is constantly crowded with small craft which transport vast quantities of merchandise to and from the southern provinces. An immense amount of traffic is also carried by the Grand Canal, which ends here.

Just outside its massive walls, 12 miles in circuit, lies the famous Si-hu or West Lake, which travelers account one of the most charming scenes in China, with swarms of gaily painted boats plying between the villas, shrines, and monasteries which line its banks and cover the many small islands. Tens of thousands of pilgrims daily visit the splendid Buddhist temples near by. Since 1896 Hangchow has been opened to foreigners for trade and residence. From the 10th to the 13th century it was the capital of southern China. Population, about 685,000.

HANKOW', CHINA. Six hundred miles up the Yangtze from Shanghai lies the Pittsburgh of China —Hankow. Its waterfront, on the north bank of the Yangtze, is a long straight stone-paved *bund*, half a mile wide and exceedingly busy. Facing it are the pretentious buildings of the foreign concessions which look out across a broad, carefully kept, tree-lined boulevard where an endless procession of men, women, and children travels afoot to and from the yellow surging river choked with traffic—gunboats, steamers, tugs, lighters, junks, sampans. Here is the center of Hankow's commerce in tea and iron.

Threading your way through streets filled with wheelbarrow drays and pedestrians, so narrow that single file is necessary, you soon sight the countless smokestacks of the Hanyang Iron and Steel Works, destined perhaps to become one of the greatest producers of iron and steel in the world. It is on the other side of the river, and the Han, which here joins the Yangtze, must be crossed in a sampan.

The mills own and operate their own coalfields, 290 miles up the river, with an estimated yearly capacity of 1,000,000 tons for 500 years; and ore deposits, 70 miles down the river and 17 miles inland, with an estimated capacity of 1,000,000 tons yearly for 100 years. Both coal and ore come to the mills by water transport. Twenty thousand Chinese work here, at 10 cents per day for unskilled and from 30 cents to 50 cents for skilled labor. Other industries are cotton, hemp, and flour mills, and tanneries. Oil is stored in great tanks for distribution. The city is an important point on the railroad between Peking and Canton. More or less modern machinery is used in these plants and some of them are under foreign management and have foreign capital invested in them. The population of the Hankow-Hanyang-Wuchang triple city is about 1,500,000.

HANNIBAL (about 247–183 B.C.). "I swear that so soon as age will permit, I will follow the Romans both at sea and on land. I will use fire and steel to arrest the destiny of Rome." The boy Hannibal stood at the altar beside his father, the great Carthaginian general Hamilcar Barca, and repeated this solemn oath of enmity against his country's powerful rival. The warrior and his young son were setting out together for Spain, where Hamilcar hoped to gain conquests that would compensate Carthage for the possessions that Rome had wrested from it in the disastrous war recently ended—the First Punic War. He was taking Hannibal with him that he might learn the ways of war and prepare to renew the death-struggle with Rome for the supremacy of the Mediterranean.

So well did Hannibal learn his lesson that after his father's death he succeeded to the command of the army in Spain, and three years later (218 B.C.) was prepared to renew the contest to which he had been dedicated. While the Roman senate was planning to invade the Carthaginian domains, Hannibal was already starting on the most daring march known to the ancient world.

Along the eastern coast of Spain, over the Pyrenees Mountains, and across the swift waters of the Rhone, he led his forces of 50,000 foot soldiers, 9,000 horsemen, and scores of elephants. It was already autumn and the cold was intense when this band, accustomed to the sunny lands of Africa and Spain, began to cross the perilous Alps. Blinded and almost overwhelmed by snowstorms, over steep and narrow paths they struggled, cheered and encouraged by their dauntless leader. In places the natives rolled heavy stones down the mountain sides upon them; many men slipped down the icy precipices and were killed; others perished of cold, hunger, and exhaustion, so that the army was reduced to less than half its original number when it descended upon the plains of northern Italy.

By the skilful use of his cavalry, in which the Romans were weak, Hannibal won two great victories, at the Trebia River and at Lake Trasimene. Alarmed at these disasters, which had shattered one army and nearly destroyed another, the Romans appointed a dictator—an official invested with extraordinary power. Their choice fell upon a wise statesman named Quintus Fabius Maximus. Instead of risking an engagement at once, Fabius adopted a policy of following the Carthaginian army, delaying it and harassing it in every possible way. From this he was nicknamed *Cunctator*, or "delayer," and even to this day cautious generals who practice similar tactics are said to pursue a "Fabian" policy.

At last, in the summer of 216 B.C., a Roman army of between 70,000 and 100,000 met Hannibal's band at Cannae, near the southeastern coast of Italy. Though far outnumbered, Hannibal managed by clever strategy to surround the forces of his enemy and annihilate them. Ex-consuls, senators, nobles, thousands of the best citizens were among the 60,000 slain. Of the gold rings which they wore as an indication of their rank, Hannibal is reported to have sent a bushel to Carthage.

Won a Great Battle but Lost the War

But the victory bore little fruit, for Hannibal was one man fighting against a nation. He failed to receive support either from his own countrymen or from the Italians that he subdued during the 15 years that he remained in Italy. His brother Hasdrubal, coming to his aid with reinforcements from Spain, was met by a Roman force, completely defeated, and slain. His severed head was hurled into the camp of Hannibal, who anxiously awaited him. Still Hannibal struggled on, until a Roman army under Scipio Africanus invaded Carthage and he was forced to return home. At Zama in his own country, the lion-hearted commander who for 15 years had ravaged Italy suffered a crushing and final defeat. The long battle for supremacy was ended and Rome was mistress of the Mediterranean.

Hannibal now showed that he could be a statesman as well as a soldier. Elected chief magistrate, he reformed and strengthened the government of Carthage and contrived to pay, without hardship to the people, the heavy tribute exacted by Rome. The Romans, alarmed by this prosperity and by the charges of his enemies that he was plotting to renew the war against Rome, demanded Hannibal's surrender. To avoid falling into their hands, he fled to Asia, and when several years later the Romans hunted him out, he took poison, which, we are told, he always carried with him in a ring.

So died one of the greatest and most gifted military leaders of ancient times; an ardent patriot, a crafty strategist, and the most formidable foe that ever threatened the Roman Republic at the height of its power. (*See* Carthage.)

HANOVER, Germany. For about 120 years the kings of Great Britain were also German princes, ruling the kingdom (formerly electorate) of Hanover in northwestern Germany. This state of things lasted from the accession of George I, the first of the Hanoverian (or Brunswick) dynasty, in 1714, until the death of his great-great-grandson, William IV. Owing to a law forbidding female succession in Hanover, that land passed to another ruler when Queen Victoria ascended the British throne in 1837. In the war between Prussia and Austria, in 1866, Hanover was allied with Austria, and victorious Bismarck thereupon annexed it to Prussia, of which it still remains a part. The area of this Prussian province is now 14,862 square miles, and its population about 3,000,000.

The city of Hanover, the capital of the province about 60 miles southeast of Bremen, contains an irregularly built "old town," with many quaint stucco-front houses, and handsome new quarters to the north and east. There are many fine parks, picture galleries and museums, a palace with magnificent decorations, and other fine buildings. Numerous manufactures—hardware, chemicals, machinery, linen, tobacco, etc.—have contributed to the city's rapid growth in the past half-century. For many years foreign students—especially English—studied in Hanover, on account of the reputed purity of the German spoken there. Population of the city, about 300,000.

HANSEAT'IC LEAGUE. A fleet of tall-masted ships met in the sound off the coast of Denmark in the spring of 1368. They came from the cities of northern Germany belonging to the Hanseatic League, which was at war with the king of Denmark. For two years they harassed the Danish coasts and waters, sacked Danish cities, and plundered their treasures. At the end of that time the king of Denmark was glad to make peace, although the terms exacted were most humiliating. The cities of the League demanded a share in the Danish revenues for 15 years, the possession of Danish strongholds, and the final voice in the selection of the Danish kings.

This episode in the history of the loose confederation of North German cities known as the Hanseatic League gives an idea of the power it then possessed. It had been growing up gradually. No one knows just when it began. More than a hundred years earlier cities had formed alliances or "hansas" to protect their traders from the plundering barons along the highways and the pirates upon the seas. These alliances proved so useful that gradually more towns joined the strongest league, of which Lübeck was the center, and this union became known as the Hanseatic League.

Just how many towns were in the league no one knows. Even its ambassadors in London, when asked for the number of towns, scornfully replied that they could not be expected to know all the places, large and small, in whose name they spoke. At the height of its power in the 14th century it probably contained nearly 100 cities, extending from Dinant in Belgium to Cracow in Poland, and its "factories" or trading-posts stretched from the "Steelyard" in London to the "Court of St. Peter's" in the far-away city of Novgorod, Russia.

In these foreign factories the representatives of the league lived almost like monks. They were forbidden to marry as long as they remained abroad. They could not leave the factory at night. Iron doors, savage dogs, and watchful guards were provided to enforce this rule. They could not associate with the people of the country except for business purposes, and they were required to be rigidly honest in their dealings, for the dishonesty of one would bring the wrath of the townsmen upon all.

But the advantages more than balanced these restrictions. Merchants of the league were exempt from the taxes and tolls levied upon others. And in some places they had a monopoly of a certain trade, as of the herring fisheries off the coast of Sweden. At the height of its power the league not only protected its merchants but also maintained its fleet and even engaged in war to safeguard its interests. It played an important part in suppressing lawlessness, in carrying comforts and conveniences into half-barbarous lands, and in promoting enlightenment and civilization throughout northern Europe.

But quarrels between the towns gradually weakened the influence of the league, for it was only a loose union whose assembly met every year or two, but had no authority to enforce its decisions. The rise of strong political states such as Denmark created rivals and enemies for the Hansa. The discovery of America and of the route around Africa lessened the commercial importance of most of the North German cities. But the death-blow to the league came when the herring suddenly deserted their haunts off the shores of Sweden for the coast of Holland. The exclusive control of the herring fisheries had been the most highly prized privilege of the league, and with that gone the members lost interest. By 1630 most of the towns had deserted the alliance, but the free cities of Hamburg, Lübeck, and Bremen continued to be known as Hansa towns until the latter part of the 19th century (*see* Bremen; Hamburg).

HAPSBURG. On the top of the Wülpelsberg (1,682 feet high), in northern Switzerland near the junction of the little river Reuss with the Aar, stands the ruined "Hawk's Castle" (*Habichtsburg*) which

WHEN HANNIBAL CROSSED THE ALPS

Here stands Hannibal, with members of his staff, directing the passage of the Carthaginian army over a dangerous spot, in the famous march from Spain across the Alps to Italy. Beset by hostile natives, exposed to the rigors of an Alpine winter, with insufficient food, and without anything approaching modern means of transport, the task of Hannibal's army was stupendous. The success with which this seemingly impossible enterprise was carried out is still a marvel to military men.

was the original seat of the famous Hapsburg (or Habsburg) family. The castle was erected in 1020, and its owners ruled Austria from 1278 to the end of the World War. With the exception of one reign (Charles VII, 1742–1745), all the rulers of the Holy Roman Empire from 1438 until the abolition of the empire in 1806 were members of the Hapsburg house. The Emperor Charles V (1519–1556) was by descent on his father's side a Hapsburg (*see* Charles V, Holy Roman Emperor). After the division of his dominions there were two Hapsburg houses, the one ruling Spain until the extinction of the line in 1700, and the other in Austria until 1918. A very full lower lip and a long pointed chin—the famous "Hapsburg chin"—became family features after a marriage with a Bohemian princess in the 15th century. (*See* Austria-Hungary.)

Harbors and Docks. The destiny of nations is largely controlled by their coast lines. Commerce, with the progress in civilization which follows on its heels, most readily springs up where there are well-sheltered harbors in which ships may safely load and unload their cargoes. Despite its vast potential wealth, Africa, with the exception of the narrow strip along the Mediterranean, remained undeveloped until the 19th century largely because it has so few natural harbors. On the other hand, the civilization we enjoy today was born in the Mediterranean lands, where many safe harbors tempted men to traverse the sea and interchange products and ideas. One of the controlling factors in bringing about the differences between the "unchanging East" and the changeful West has been the abundance of harbors in Europe and their comparative scarcity in Asia. The importance of harbors is particularly noticeable in the history of North and South America, for nearly all the early centers of settlement were at some bay or river mouth which afforded shelter to the vessels of the first arrivals.

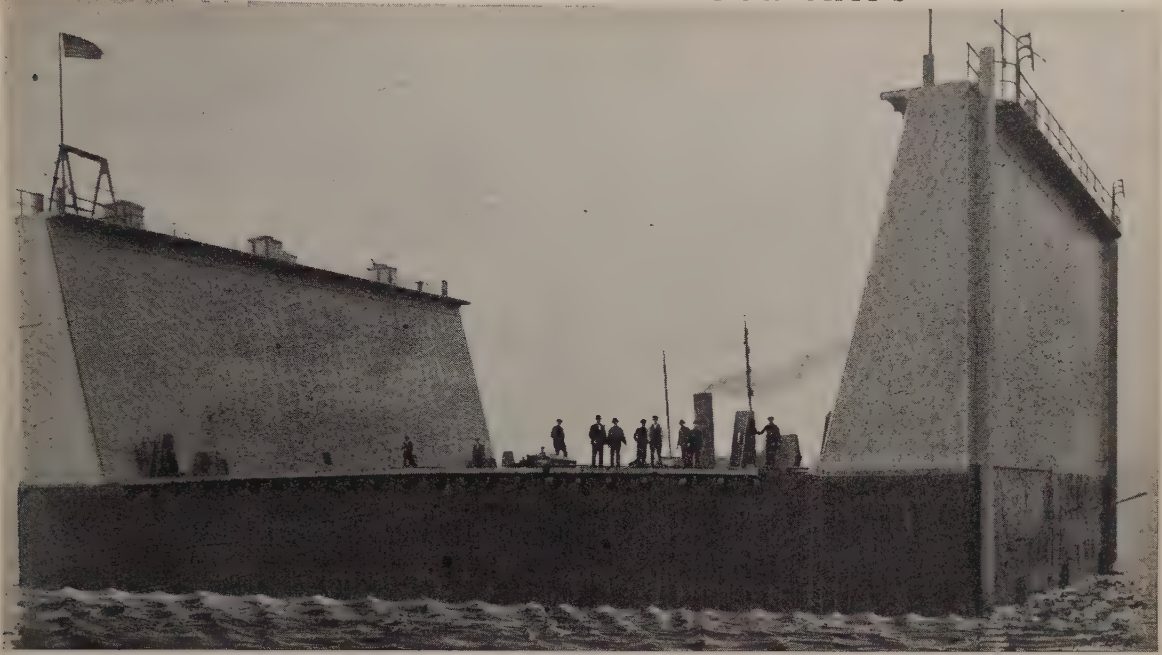
Immense sums have been spent to improve natural harbors or to construct artificial ones. Tremendous breakwaters and jetties have been built far out into the sea to break up heavy seas and afford a safe refuge. Other jetties have been built to narrow the channel and increase the scouring effect of the current, thus deepening the water. Constant dredging is necessary in many harbors to remove the sand and silt deposited by tides and rivers. At London, Liverpool, Havre, and many other tidal harbors immense "wet docks" have been built, with miles of basins to which ships are admitted by gates that retain the waters when the tide runs out.

HELPING NATURE PROVIDE A HARBOR FOR MARSEILLES

This picture of the entrance to the so-called "old harbor" of Marseilles shows how artificial works are used to improve natural harbors. Although the land-locked bay provides good shelter for vessels riding at anchor, the French engineers have erected breakwaters to break the force of the waves across the harbor's mouth and dredged basins in order to let big ships come alongside the docks. The ships we see here are mostly French naval vessels.

In many cases river channels have been dredged deeper or canals have been built to turn inland cities into harbors which receive ocean-going vessels. Perhaps the leading example is the city of Manchester,

A FLOATING HOSPITAL FOR SHIPS

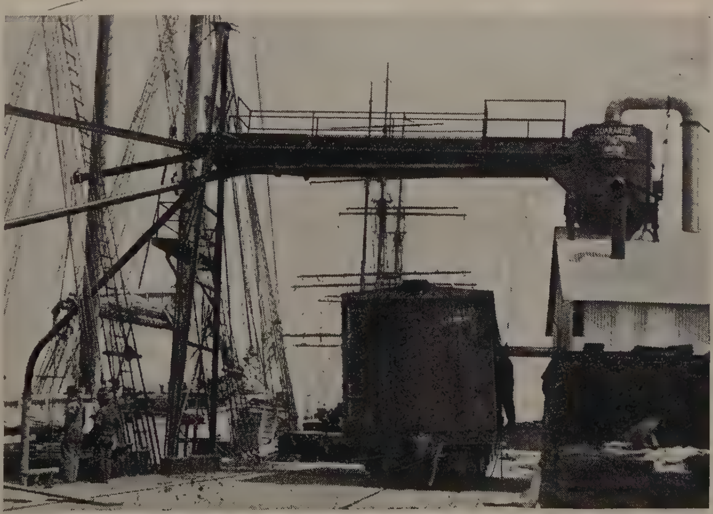


Here is a section of a great floating dry-dock, of the type used to hoist large ocean-going vessels out of the water, so that repairs may be made upon their hulls. When a vessel is to be raised, several such sections are brought together, and water is admitted to the space between their walls until their "floors" sink below the surface. The ship then moves in between the sides of the dock, and the water is pumped out again from the hollow walls, raising the hull clear of the waves. Long supports or "shores" are thrust out, of course, from the sides to keep the vessel from tipping over in its berth during this process.

England, which is connected with the ocean by the Mersey River and the famous Manchester Ship Canal, 35 miles long, allowing steamers to unload cargoes from foreign ports in the Manchester docks. Another notable instance is the port of Hamburg, 75 miles from the sea. Continuous dredging has deepened the channel of the Elbe from 15 feet to about 40 feet, so that the largest steamers can ascend it. Its vast harbor was almost all made by excavation.

Among harbor improvements are also included the extensive warehouses for storing freight while it awaits transportation. Even more important is the need for quick and easy shipments between the seacoast and the interior of the country. This usually takes the form of railroad tracks leading down to the dock, so that freight may be transferred directly from ship to car or from car to ship.

A MODERN SYSTEM FOR UNLOADING



The machinery on the dock is transferring copra (dried cocoanut kernels) directly from the hold of the schooner to the freight car on the track. The pneumatic tubes on the left draw up the copra, carry it over the "bridge" and deliver it into the car from the right. The building contains the pumps which provide the suction.

All great harbors are equipped with facilities for repairing ships, chief of which are "dry-docks." These consist of large basins, now usually built of concrete, which can be closed with water-tight gates after a vessel has entered. The water is then pumped out, or allowed to run out with the tide, the ship being held upright by "shores" or supports, while workmen scrape, mend, or paint the hull. Floating dry-docks are sometimes used in place of stationary dry-docks. These consist of great pontoons of wood or steel, forming a bed for the ship. When the pontoons are filled with water, the ship floats in above them; they are then pumped out, raising the ship clear of the surface.

In the WHITE HOUSE *after the* WORLD WAR

"MUCH has been said of late about world ideals, but I prefer to think of the ideal for America. I like to think there is something more than the patriotism and practical wisdom of the founding fathers. It is good to believe that maybe destiny held this New World republic to be the supreme example of representative democracy and orderly liberty by which humanity is inspired to higher achievement. It is idle to think we have attained perfection, but there is the satisfying knowledge that we hold orderly processes for making our government reflect the heart and mind of the republic. Ours is not only a fortunate people but a very common-sensical people, with vision high but their feet on the earth, with belief in themselves and faith in God. Whether enemies threaten from without or menaces arise from within, there is some indefinable voice saying: 'Have confidence in the republic! America will go on!'"—Speech of Acceptance, July 22, 1920.

HARDING, WARREN GAMALIEL (1865–1923). Few presidents have come into office with a more difficult task confronting them than that which faced the 29th president of the United States on his inauguration, March 4, 1921.

In the first place, owing to party differences the Versailles peace treaty, in the negotiation of which President Wilson had taken part on behalf of the United States, had failed of ratification in the Senate. This left the United States technically in a condition of suspended warfare with Germany and Austria and with no share in the new League of Nations—which, indeed, had been the chief stumbling-block to the ratification of the peace treaty. Friends of Germany and Austria were resentful at the harsh terms imposed upon those countries; an irreconcilable group of Republican senators demanded the complete "scrapping" of the League of Nations covenant; humanitarians urged that the United States aid the suffering Armenians in safeguarding their new freedom against the massacring Turks; radicals demanded that Bolshevist Russia should be given a chance to work out its salvation, while reactionaries clamored for more stringent measures against "reds" of all sorts; jingo elements labored indefatigably for sterner measures against Japan and Mexico; and the "Friends of Irish Freedom" exerted every pressure to induce the United States to recognize the independence of "the Irish Republic."

Serious Problems to Be Faced at Home

Domestic problems were equally pressing. Heavy taxation and the "high cost of living" were legacies of the war; and business demanded relief from the one while the buying public clamored for a lightening of the burdens of the other. A financial stringency and much unemployment accompanied the economic readjustment. Labor and capital were equally tenacious of advantages gained and resentful of losses incurred. The relinquishment by the Federal government of those powers of control over public necessities—such as food, fuel, and transportation—which it had perforce assumed during the war, carried with it no release from the exceptional problems arising out of these necessities in the transition to peace.

Warren G. Harding of Ohio, who was nominated for the presidency on June 12, 1920, by the Republican convention at Chicago, was a "regular of regulars," and his personality has been compared to that of his Ohio predecessor, President McKinley. He was born in Corsica, Ohio, where his father was a local physician. He was educated at Ohio Central College, Iberia, Ohio; became the publisher of the Marion (Ohio) *Star;* married in 1891 Florence Kling of Marion; was elected to the Ohio senate in 1900, and to the lieutenant-governorship in 1904. He was the unsuccessful Republican candidate for the governorship of Ohio in 1910; and in 1915 was elected to the United States Senate. As a member of the Senate Committee on Foreign Relations, he had favored the ratification of the peace treaty with reservations "sufficient to safeguard the interest of the United States of America."

The Campaign and the League of Nations

The issues on which the campaign was fought were chiefly the respective records of the Democratic president and the Republican Congress. The League of Nations—and in particular Article X of the covenant—constituted the chief point of Republican attack. Both Senator Harding and his opponent, Gov. James M. Cox of Ohio, were pronounced "safe and sane" by business and financial interests. Neither was opposed by organized labor.

The election resulted in a Republican "landslide" of almost unprecedented dimensions. Senator Harding received a total of 404 electoral votes, a majority of 277 over Governor Cox, and the Republican majority in both houses of Congress was increased.

Among the first measures put through by the new administration were the adoption of a national budget system, abolition of the excess profits tax, revision of the tariff, restriction of immigration, and the conclusion of peace with Germany and Austria. Immigration was restricted by limiting the number of persons of any nationality admitted in any one year to three per cent of the number of that nationality in the United States at the census of 1910. The Fordney-McCumber tariff act, which was adopted in September 1922 after many months of discussion, restored the principle of high protection, with a "flexibility" provision whereby the president could change rates to meet conditions on the advice of the tariff commission. A number of measures designed to aid agricultural interests were passed at the instance of the "farm bloc," an informal nonpartisan organization of congressmen especially interested in the problems facing agriculture. At the congressional elections in Novem-

WARREN G. HARDING

ber 1922, the Republican majority in the Senate was cut from 24 to 10, and in the House from 165 to 15.

In foreign affairs President Harding's policy was to keep the United States from becoming involved in European politics. The administration therefore declined to take part in the Genoa and Hague conferences, and withdrew the American unofficial representatives on the Reparations Commission. The American troops stationed on the Rhine were gradually reduced in number, and the last of them were ordered home in January 1923, when France announced its intention of invading the Ruhr.

Mr. Harding did not, however, share the views of those who favored complete American isolation. He repeatedly expressed his desire to strengthen the bonds of friendship between the nations and to promote peace. To this end he urged American participation in the Permanent Court of International Justice at The Hague, and called an international conference at Washington in November 1921.

HARDING'S ADMINISTRATION

1921-1923

Budget Bureau established.
Treaty ratified giving Colombia $25,000,000.
Bill passed restricting Immigration.
Peace with Germany and Austria declared (July 2, 1921).
Washington Conference on Limitation of Naval Armament.
Strikes of Coal Miners and Railroad Shop Workers (1922).
Fordney-McCumber Tariff Act restores High Protection.
Soldiers' Bonus Bill vetoed.
Republicans lose 14 seats in the Senate and 150 in House.
Last of American Troops on Rhine ordered home (1923).
Death of President Harding

This conference was the most conspicuous achievement of Mr. Harding's foreign policy. It resulted in treaties between the United States, the British Empire, France, Japan, and Italy limiting naval armament, restricting the use of submarines and abolishing the use of poisonous gases in warfare. Another treaty between the first four powers bound them to respect the *status quo* in the Pacific and in cases of disagreement to refer the dispute to a conference. Two more treaties, between the five powers with the addition of Belgium, China, the Netherlands, and Portugal, provided for the maintenance of China's integrity and sovereignty, and the principle of the "open door." Out of the conference also grew an agreement on the part of Japan to withdraw immediately from Shantung.

When the President had completed a little more than half of the term for which he had been elected, death suddenly brought his career to an end. In the summer of 1923 he set out on a tour of the western states and Alaska, in the course of which he made a series of momentous public speeches. On July 28 signs of ptomaine poisoning appeared, followed by a slight attack of pneumonia. Five days later, (August 2) when the crisis had apparently been passed, Mr. Harding died without warning from a stroke of cerebral apoplexy, in San Francisco.

Whatever estimate future generations may place on President Harding as a statesman, there can be no two opinions regarding his qualities as a man. He was respected by friend and foe alike for his devotion to duty, his highmindedness, his personal charm, and his unfailing tact and amiability.

HARDY, THOMAS (born 1840). Although the books of this great tragic novelist are too gloomy and pessimistic to be "popular," he is one of the few writers whose works have been accepted as classics in their own lifetime. Born near Dorchester in Dorsetshire, England, he has passed most of his long life, as did his ancestors before him, in that region of woodland and heath and moor which he calls by its old name "Wessex" and which forms the setting of most of his writings. He was educated at local schools and by private tutors and for a time studied at King's College in London. At 16 he began the study of architecture and at 22 went to London as assistant to an architect. He had already begun to write and for a time was uncertain whether to make architecture or letters his profession, but after his first really successful novel, 'Far from the Madding Crowd', was published in 1874, he decided to retire to Dorsetshire and devote himself to literary work. But doubtless architecture had much to do with the wonderful constructive power shown in his novels.

Hardy is interested in the simple primitive men of the countryside with their strong elemental instincts and passions. Still more is he concerned with nature in all its moods and changes, not only as the great background against which he shows man moving onward to his destiny, but as a power which enters into the very life of man, sometimes sympathetic, more often cruel.

What Meredith called his "twilight view of life" gives to most of his work an atmosphere of melancholy and pessimism. Though he is thoroughly modern in the realism with which he depicts common life, even in its ugly and sordid aspects, Hardy is like the old Greek dramatists in his presentation of innocent or helpless men or women as the victims of a relentless fate. It is this that makes his 'Tess of the D'Urbervilles' one of the most terrible as well as the most artistic of all novels.

Hardy's chief novels are: 'Under the Greenwood Tree' (1872); 'Far from the Madding Crowd' (1874); 'The Return of the Native' (1878); 'Tess of the D'Urbervilles' (1891); 'Jude the Obscure' (1895); 'The Well-Beloved' (1897); 'A Changed Man' (1913). His poetry includes 'Wessex Poems' (1898), and an epic drama in three parts, 'The Dynasts' (1903-1908).

"BRER RABBIT" *and His* RELATIVES

HARES AND RABBITS. Do you know the difference between a hare and a rabbit? If you do, you know more about these animals than a great many people. In America all members of the family to which hares and rabbits belong—and it is said there are 30 species—are usually called "rabbits," although most of them are hares. Wild rabbits are smaller and have shorter ears and shorter hind legs than the hares. They live and breed in burrows and their young are born blind and nearly naked. Hares do not burrow and their young are covered with fur at birth and have their eyes open. The hind legs of hares are longer than their fore legs; this gives them an awkward appearance but enables them to run faster up hill than down. Rabbits breed five or six times a year; hares two or three times. There are from four to six young in a litter of either variety. Young rabbits breed when they are about six months old, but they do not attain their full growth until they are a year old.

Hares and rabbits are rodents, or gnawing animals, but unlike any other rodents they possess two small incisors, or cutting teeth, behind the large ones in the upper jaw. Scientists believe that these teeth are remnants of two additional incisors possessed by their ancestors, and possibly by other rodents, many years ago (*see* Evolution). Their upper lips are cleft and that is why a deformity of the upper lip in human beings is called "hare-lip." Their tails are short and stand erect. They have five toes on the fore feet and four on the hind feet. They are mostly nocturnal in their habits, that is, they usually remain "at home"—the rabbits in their burrows, and the hares in their "forms," as their nests are called—during the day, and go out to feed at night. They feed upon vegetables, grass, leaves, buds, berries, and the bark of trees and shrubs. They are fond of clover, cabbage, dandelion leaves, and carrots, and sometimes do much damage to gardens.

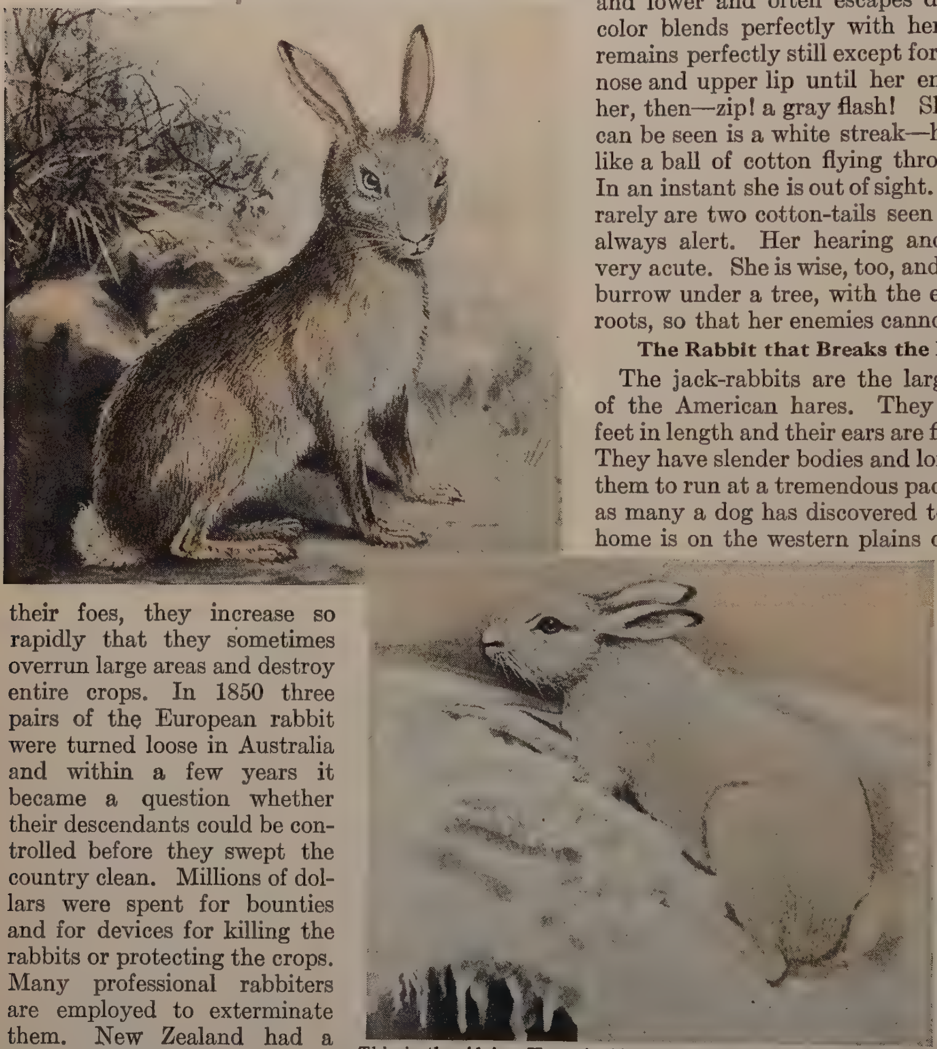
Hares and rabbits are timid but they fight bravely in defense of their young, and in self-defense. They are capable of striking powerful blows with their hind feet and have been seen to knock over a weasel and kill a snake. Domesticated rabbits generally live peacefully with cats, but when differences arise the rabbit usually succeeds in making the fur, as well as the cat, fly. In avoiding their enemies they display much ingenuity and some observers give them credit for being as clever as foxes. When pursued they have a habit of stopping suddenly, almost under the feet of their enemy, and turning with incredible swiftness to run in another direction.

How the Hare Gets His Speed

Their tremendous speed is due to their peculiar method of running, to which the structure of their legs is eminently fitted. When the hare or rabbit takes to flight he leaves the ground with a tremendous leap and for an instant is completely extended. While in the air, however, he brings his hind legs forward until they project beyond and above his head. While bunched in this position, his fore paws strike the ground, one ahead of the other. His momentum tilts him forward, and at the same time he starts swinging his hind legs downward. They strike the ground side by side, but at a spot far ahead of where the front feet are planted. Doubled up thus like a spring, the rabbit "uncoils" suddenly in his next great leap. This method of running is the cause of the peculiar appearance of rabbit tracks familiar to all hunters. They form a pattern like a human face, the marks of the hind paws corresponding to the eyes, and of the fore paws to the nose and mouth. Measurement of these tracks shows that a frightened jack-rabbit covers 15 to 20 feet at a bound.

By man these animals are persistently hunted for their tender and wholesome flesh, and for their fur, which is used to make felt hats. In addition to man, all the beasts and birds of prey are their natural enemies. They are the constant food of wolves, coyotes, lynxes, foxes, mountain lions, and wild cats, and are preyed upon more or less by badgers, skunks, minks, weasels, owls, and hawks. Yet, despite all their foes, they increase so rapidly that they sometimes overrun large areas and destroy entire crops. In 1850 three pairs of the European rabbit were turned loose in Australia and within a few years it became a question whether their descendants could be controlled before they swept the country clean. Millions of dollars were spent for bounties and for devices for killing the rabbits or protecting the crops. Many professional rabbiters are employed to exterminate them. New Zealand had a similar experience a few years later (*see* Australia).

A ''TURNCOAT'' AMONG HARES



This is the Alpine Hare, in his summer dress above, and in his winter dress below. This long eared fellow is found in Ireland, northern Europe, and as far east as Japan. Many naturalists believe the American Polar Hare belongs to the same species. The change to white in winter helps to make him invisible to his many enemies against the background of snow.

Hares and rabbits belong to a single genus, *Lepus*. The best known and most common American species is the little gray rabbit, or cotton-tail. It is a rabbit, although it does not burrow to the extent indulged in by its European brother, and its young are frequently born in nests, or forms, above ground. The mother cotton-tail generally lines the nest, or covers her naked young ones, with fur from her own body. The total length of the cotton-tail is 17 inches; its general color is cinnamon brown, grayer behind. It is white underneath with a gray stripe across the breast. The under surface of the tail is pure white. The range of the cotton-tail and its allied species is almost the whole of the United States.

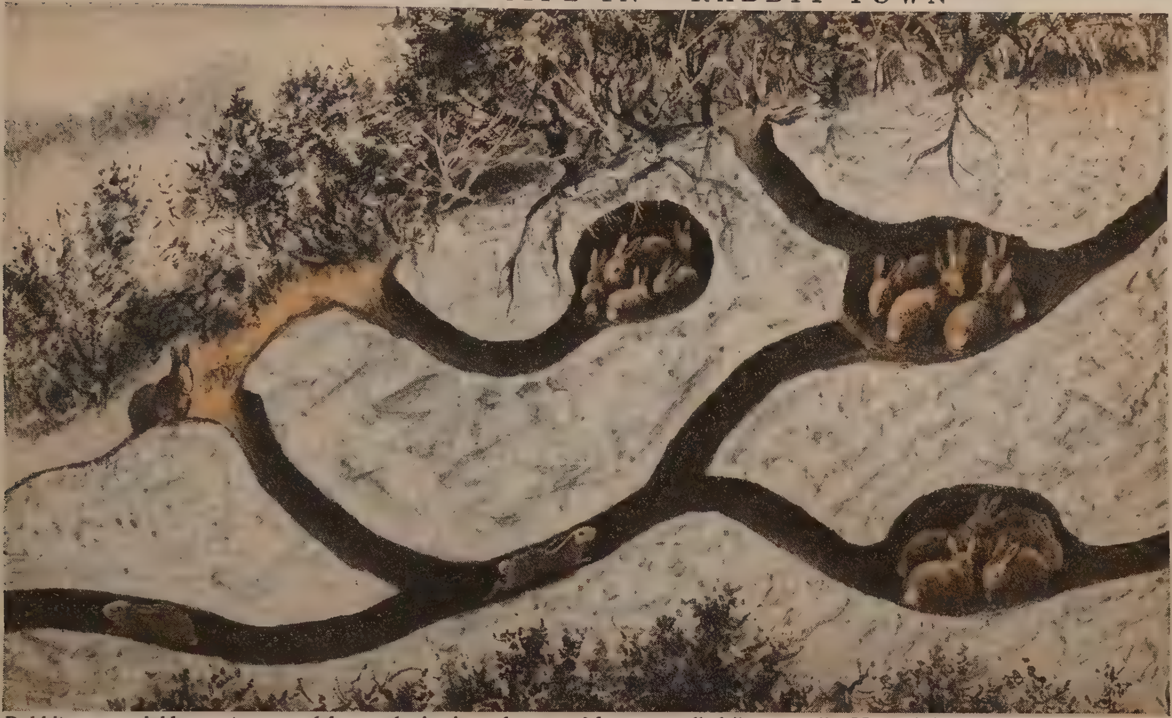
"Molly Cotton-tail" has an interesting habit of crouching in her resting place and remaining motionless when an enemy approaches. She crouches lower and lower and often escapes detection because her color blends perfectly with her surroundings. She remains perfectly still except for the twitching of her nose and upper lip until her enemy is almost upon her, then—zip! a gray flash! She is off and all that can be seen is a white streak—her tail—which looks like a ball of cotton flying through the underbrush. In an instant she is out of sight. Molly lives alone—rarely are two cotton-tails seen together—and she is always alert. Her hearing and sense of smell are very acute. She is wise, too, and prefers to make her burrow under a tree, with the entrance between the roots, so that her enemies cannot dig her out.

The Rabbit that Breaks the Running Record

The jack-rabbits are the largest and best-known of the American hares. They are more than two feet in length and their ears are five or six inches long. They have slender bodies and long legs, which enable them to run at a tremendous pace for short distances, as many a dog has discovered to its distress. Their home is on the western plains of the United States, ranging southward to central Mexico and northward to Saskatchewan. Jack-rabbits increase rapidly and frequently cause much damage to crops. At such times thousands are killed by poisoning and by organized drives in which whole communities participate. The prairie hare is not a jack-rabbit, although it is generally so called. It is smaller than the jack-rabbit, and its color becomes white in winter.

The varying hare, or snow-shoe rabbit, is smaller than the prairie hare but considerably larger than the gray rabbit. Its range is the northern part of the United States and Canada to the Arctic Circle. It sheds its hair twice a year, changing color each time, becoming white in the fall and gray in the spring. It does not get on well with the gray rabbit, and

UNDERGROUND LIFE IN "RABBIT TOWN"



Rabbits are sociable creatures, and form colonies in underground burrows called "warrens." Most of the passages are connected together, with little side "pockets" in which individual families dwell. Mother rabbits, however, usually have separate burrows, as you see in the center of the picture, until the little ones are well grown. The main warren always has two or more entrances, so that if enemies such as weasels and ferrets come in one door, the inhabitants can run out through another. Usually the entrances are made behind the concealing protection of a bush or rock.

leaves the neighborhood when the latter become numerous.

The polar hare is found in the far north, and like other animals of that latitude is snow white, but in the southern part of its range it turns gray in summer. The polar hare has been found within 400 miles of the North Pole. His beautiful fur is highly prized and more than 5,000,000 of these animals and other white-haired varieties are trapped every year.

The swamp hare and the marsh hare are southern varieties that take readily to water and feed on aquatic plants.

In the Old World the common hare is found in all parts of Europe except Ireland, Scandinavia, and northern Russia. It is 20 to 22 inches long and weighs from 6 to 8 pounds. The Alpine hare resembles the varying hare of America. The polar hare is found in Scandinavia and northern Russia; and in Ireland a distinct species (*Lepus hibernicus*) is found.

The European Cony and Other Varieties

The European rabbit or cony differs from the American gray rabbit in many respects. It lives in colonies in burrows called warrens, and in the wild state it is said to mate for life. It feeds at dusk in the morning and evening, and remains in its burrow during the day. This is the species that was introduced into Australia and New Zealand and overran those countries. It is also the ancestor of most of the domestic varieties, many of which have outstripped it in size.

All of the domestic varieties, including the Belgian hares, are rabbits. The Belgian is well known in America, where it is widely bred. It weighs about 10 pounds. The Patagonian is the largest, weighing from 12 to 16 pounds. The lop-eared rabbit is larger than the Belgian and is remarkable for its ears, which lop, or hang down and are from 10 to 12 inches long and 6 inches wide. The Angora is noted for its long, silky fur. Other domestic breeds are the Polish, Flemish, Himalayan, Dutch, Siberian, and silvertip. Snow-white rabbits with pink eyes, called albinos, are favorite pets. They are pretty, easily kept, and become very fond of their keepers.

High in the mountains of northwestern North America lives a queer little rabbit-like rodent called the pika or cony. Other names for it are the tailless hare and the whistling hare. The appearance of the pika is something between that of a guinea-pig and a very small rabbit. Its feet are padded with fur, so that it can leap from rock to rock without losing its footing.

Scientific name of gray rabbit or cotton-tail, *Lepus sylvaticus;* of jack-rabbit, *Lepus callotis;* of prairie hare, *Lepus campestris;* of varying hare, *Lepus americanus;* of polar hare, *Lepus arcticus;* of swamp hare, *Lepus aquaticus;* of marsh hare, *Lepus palustris;* of the Old World common hare, *Lepus vulgaris;* of Alpine hare, *Lepus timidus;* of European rabbit, *Lepus cuniculus.*

TALES THE WOODMAN TOLD

HOW MR. RABBIT LOST HIS TAIL

ONE day, when the Little Boy came to the Woodman's cabin, the ground was all white with new-fallen snow.

"What made those funny marks?" the Little Boy asked. And he pointed to some tracks in the snow that twisted and turned and skipped and hopped, all about the cabin and in the fields and wood beyond.

He had a long tail like a Fox

"Those?" said the Woodman. "Why, those are *rabbit* tracks." Then his eyes twinkled, as they always did when he thought of something funny. "Did I ever tell you how Mr. Rabbit lost his tail, and got his white winter coat so that he can run about in the snow without being seen?

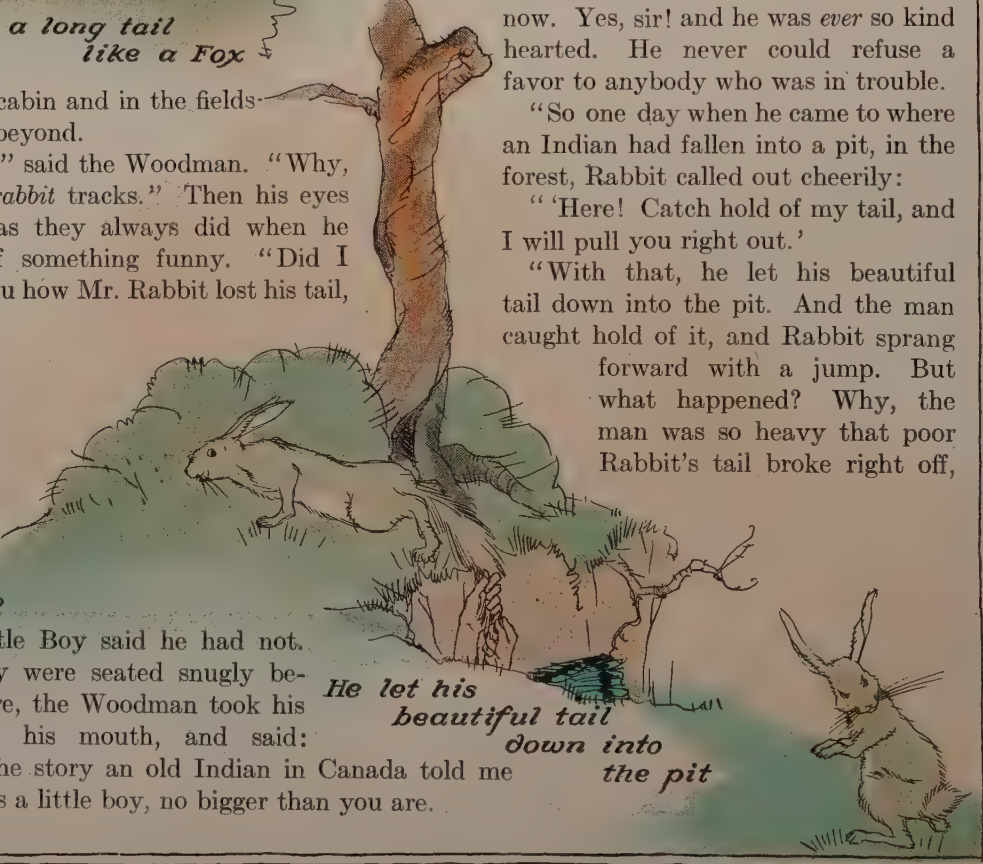
The Little Boy said he had not. When they were seated snugly before the fire, the Woodman took his pipe from his mouth, and said: "This is the story an old Indian in Canada told me when I was a little boy, no bigger than you are.

"A long time ago the Rabbit was a very grand and beautiful animal. He had a long bushy tail like a fox, and he wore a thick brown coat winter and summer. His legs were ever so straight and strong, and he walked and ran just like other animals, and did not hop and skip about as he always does now. Yes, sir! and he was *ever* so kind hearted. He never could refuse a favor to anybody who was in trouble.

"So one day when he came to where an Indian had fallen into a pit, in the forest, Rabbit called out cheerily:

" 'Here! Catch hold of my tail, and I will pull you right out.'

"With that, he let his beautiful tail down into the pit. And the man caught hold of it, and Rabbit sprang forward with a jump. But what happened? Why, the man was so heavy that poor Rabbit's tail broke right off,



He let his beautiful tail down into the pit

Most anybody else would have left him there after that

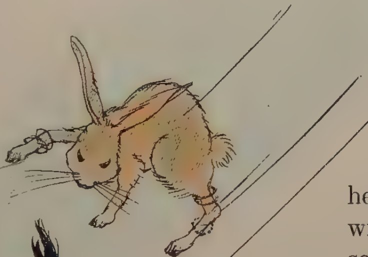
about an inch from its root! And the man fell back again into the pit.

"Most anybody else would have left him there after that! But Rabbit wasn't one to give up an act of kindness when he once set about it. So he seized a tree with his fore paws, and said:

"'Just take hold of my hind legs, and hold on tight.'

"Then the man pulled, and Rabbit pulled, and at last the man was hauled out of the pit.

"But Rabbit's beautiful hind legs were all pulled out of shape! He couldn't walk straight any more, but had to hop along in a funny jumpy sort of fashion.



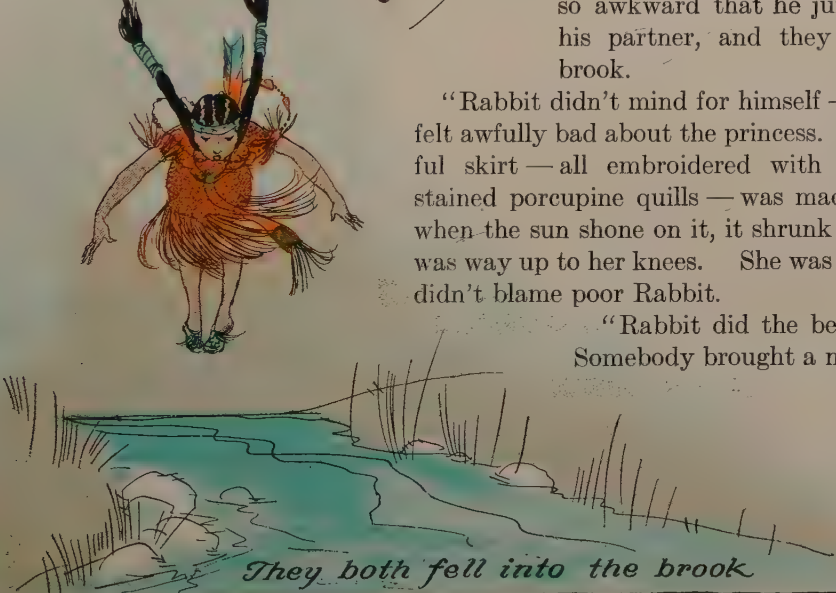
"Of course the man was very grateful to Rabbit. To show his thanks he invited Rabbit to go with him to his wedding; for you see he was on his way to marry a beautiful Indian princess.

"There was great fun at the wedding. Rabbit put rings on his heels and bangles on his neck, and danced with the bride. But his new hind legs were so awkward that he jumped too high with his partner, and they both fell into the brook.

there was great fun at the wedding

"Rabbit didn't mind for himself — not a bit! But he felt awfully bad about the princess. You see, her beautiful skirt — all embroidered with colored beads and stained porcupine quills — was made of buckskin; and when the sun shone on it, it shrunk and shrunk, until it was way up to her knees. She was so ashamed, but she didn't blame poor Rabbit.

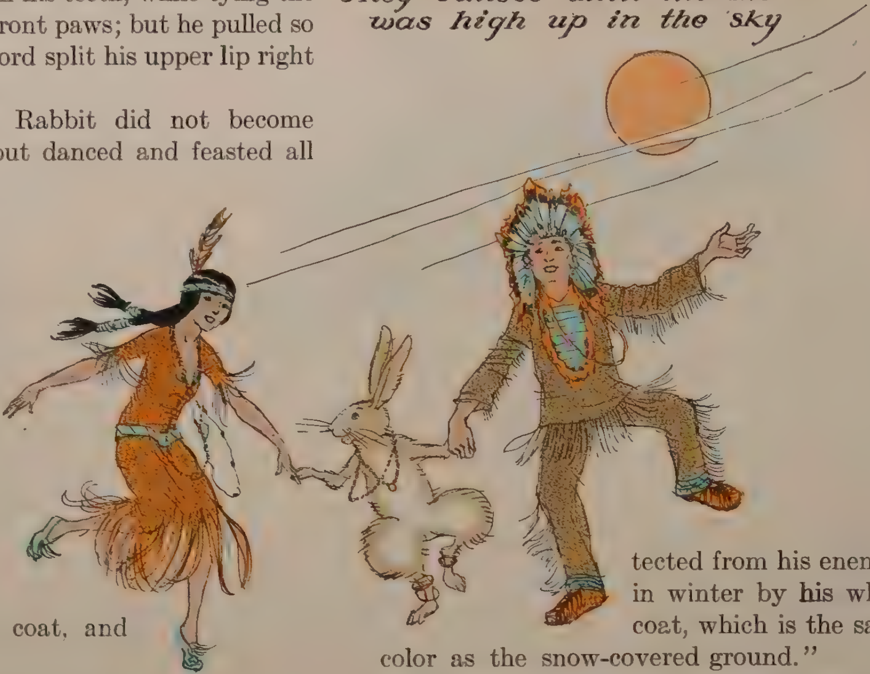
"Rabbit did the best he could for her. Somebody brought a nice tanned deerskin, and he fastened it to the bottom of the bride's skirt. But he was so flustered that this brought him



They both fell into the brook

into new trouble. He held one end of the buckskin cord in his teeth, while tying the other with his front paws; but he pulled so hard that the cord split his upper lip right up to the nose!

"Even then Rabbit did not become downhearted, but danced and feasted all the evening.



They danced until the moon was high up in the sky

"When the party broke up, the man offered to pay Rabbit for all he had done for him. Rabbit did not want to take any payment. But the princess gave him a soft white fur coat, and said:

"'In winter wear this white coat for me. It is the color of snow. But in summer you must wear your old brown coat, which is the color of the dead leaves and grass.'

"So Rabbit took the coat. And ever since — although his lip remains split, and his tail is a mere fluff of cotton, and he goes *hippity-hop* on account of his bad legs — he is protected from his enemies in winter by his white coat, which is the same color as the snow-covered ground."

The Woodman leaned over and picked up a live coal from the fireplace with his fingers, and put it in his pipe, which had gone out.

"Is that story *really truly* so?" asked the Little Boy, with wide eyes.

"Well, perhaps not," said the Woodman. "But anyway that's the story the Indians tell. And you can see for yourself, next time you find a rabbit in the winter."

"In winter wear this white coat for me," she said

Hargreaves, James (1730–1778). Before the year 1764 little is known about the life of the inventor of the "spinning jenny" beyond the fact that he was a skilled spinner and carpenter who had already made an ingenious "carding" machine for his own use, and that he was living in Stanhill (in Lancashire), where he was probably born about 1730. Then, as now, Lancashire was the center of England's manufacture of cotton goods, but the industry was still primitive, being carried on in the workmen's homes and with hand "cards," spinning wheels, and looms.

Hargreaves' crowded cottage sheltered his family and his workshop. One of the seven children overturned his father's whirling wheel, a lucky accident that gave him the idea for his great invention. Hargreaves had already been experimenting with spinning two threads at once, with the wheel upright and the two spindles held horizontally, but the threads were in too close contact and constantly became tangled. When the wheel was upset the spindles were vertical, and the threads flew apart as wide as the wheel's diameter. Hargreaves seized the idea and set spindles vertically in a frame, so that he was soon able to spin 16 threads at once. This was probably in 1764. He called his machine a "spinning jenny," some say in honor of his wife and others of his daughter.

The amount of cotton yarn he began to turn out alarmed his rivals, who feared his wizard machine would leave nothing for them to do; so they broke into his house and destroyed his spinning jenny. He built another in secret and carried it away to the large town of Nottingham, where he set up a yarn mill. His invention brought him fame but little profit, for when he applied for a patent he was told that he had forfeited his rights by selling several of his machines. Being unprotected by patent the spinning jenny soon came into wide use and the production of yarn was greatly increased.

Other inventors were also at work in solving the same problem, and before Hargreaves' death, in 1778, mechanical spinning was fully developed by Richard Arkwright and Samuel Crompton. The stories of these two inventors, told in separate articles in this work, are sequels to this sketch of James Hargreaves, as is also that of Edmund Cartwright, the inventor of the power loom.

Harold, King of England (1022?–1066). The reign of the ill-starred Harold II, the last king of the Anglo-Saxon period, lasted less than nine months. He was crowned upon the death of Edward the Confessor, in January 1066, and lost his life in October, when the Norman William the Conqueror defeated his troops in the famous battle of Hastings. Ever since that day—except during the days of Cromwell—the English throne has been held by descendants of the Norman conqueror.

For several years before the death of Edward, Harold had been the chief man in the kingdom, and when Edward died without direct heirs, Harold was chosen by the assembly of nobles to succeed to the throne. William, Duke of Normandy, laid claim to the English kingship on the strength of a promise made by Edward that the crown should descend to him, and because of an oath sworn by Harold to aid him. When William invaded England to make good his claim, Harold was in the north, where he had been called to repel an attack by the Danes. Hastening south with his troops, Harold met the Norman invaders, only to fall on the field, surrounded by the corpses of the bravest men of England. (*See* Edward, Kings of England; Hastings, Battle of; William, Kings of England.)

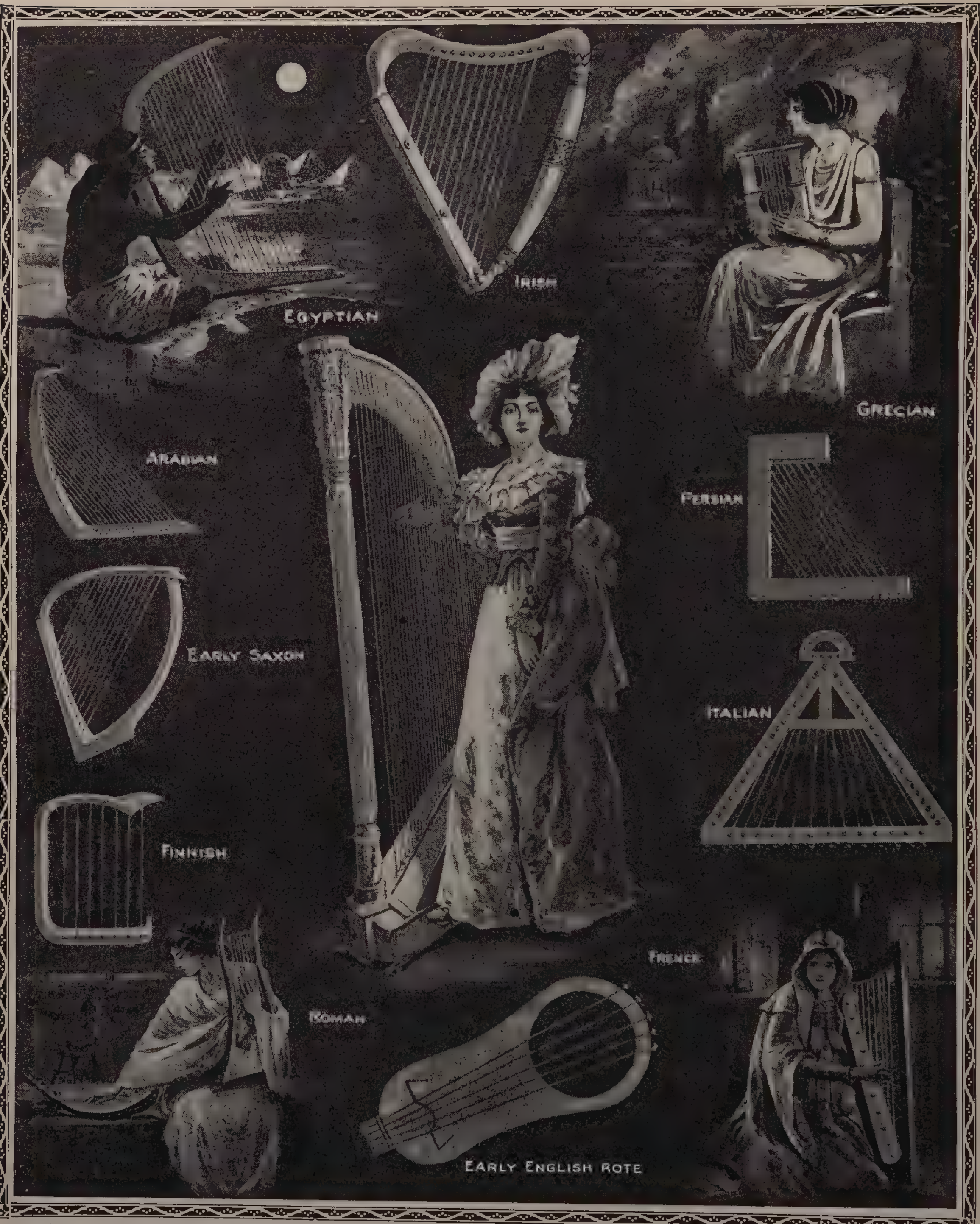
Harp. The harp is the most ancient of stringed instruments. From primitive times men knew that a stretched bowstring gave out a pleasing twanging sound when it was plucked. It is easy to see how some musically inclined genius conceived the idea of adding other strings of different lengths, thus producing an instrument on which simple melodies and chords could be produced. Greek legend tells how the cithara or lyre, a harplike instrument, was invented by the precocious god Hermes (Mercury), who put strings across a tortoise shell a few hours after his birth and made sweet music. The great antiquity of the harp is also indicated by Egyptian paintings, thousands of years old, which picture the harp in various stages of development, from a form obviously derived from the hunter's bow to elaborately carved triangular instruments much like the beautiful harp of modern days. Some of these early Egyptian harps, dating from about 1500 years before Christ, are still to be seen in the British Museum. Much like these were the harps used by the ancient Hebrews in their religious ceremonies and by the ancient Irish people.

In the modern harp the strings are stretched between the sounding board, which rests against the player, and a gracefully curved bracket connecting the top of the sounding board with an upright pillar. Through this pillar pass rods, worked by pedals at the base of the harp, by means of which the pitch of the strings is changed so that the harp can be used in any key.

If a pedal is pressed half-way down, the note is raised a semi-tone; if pressed fully down, it is raised a tone. At one side of the grooves in which the pedals work in the pedestal of the harp are two notches into which they can be hitched when required. So you see that three different tones can be produced on every one of the about 46 strings, giving the harp a very wide range.

These ingenious double-action pedals—of which there are seven—were invented by Sebastian Erard (1752-1831), a French manufacturer of musical instruments, who was also distinguished for his improvements upon the pianoforte. By perfecting the harp in this and other respects, Erard greatly amplified its possibilities for orchestral use, so that now the great scores of Meyerbeer and Gounod, of Berlioz, Liszt, and Wagner are not complete without it.

THE HARP'S ETERNAL CHARM



Of all the musical instruments known to us today, the harp is one of the oldest and most widely popular. In the dawn of history it provided music beneath the Egyptian moon and the sunny skies of Greece, and even in the somber northland of Europe it accompanied the songs of semi-civilized entertainers in Gaelic and Saxon courts. These early harps were far simpler than the modern instrument. The artisans of those days had not learned to build a framework strong enough to support the tension of long heavy strings; and music had not progressed to a point where a wide range of notes was needed for its expression. As time went on however, hand in hand with increased musical skill came increased ability to build harps capable of holding their shape against the pull of great strings, and finally the harp emerged about a century ago in the form we know it—in principle essentially the same as the earliest Egyptian, but capable of yielding an immensely greater variety of musical effects. The present-day harp presents such difficulties and possibilities that a performer can easily spend a lifetime in study and practice without mastering all the difficult points of technique to his satisfaction.

The harp is one of the most difficult of instruments to play and skilful harpists are very rare. But to be able to waken its beautiful tones must well repay long hours of patient study, for its voice is unlike that of any other instrument.

HARPIES. In ancient mythology the harpies were conceived as repulsive creatures—birds with the faces of old women, the ears of bears, and crooked talons. One legend relates how Phineus, king of Salmydessus, in Thrace, deprived of his sight by the gods for his ill-treatment of his sons, or for revealing the future to mortals, was condemned to be tormented by two harpies who snatched away whatever food was placed before him and devoured it. In Homer their function is to carry off to the underworld or to some spot beyond human ken those whose sudden disappearance is desired by the gods. The name harpies means "the robbers" and they are supposed to be a personification of the storm winds.

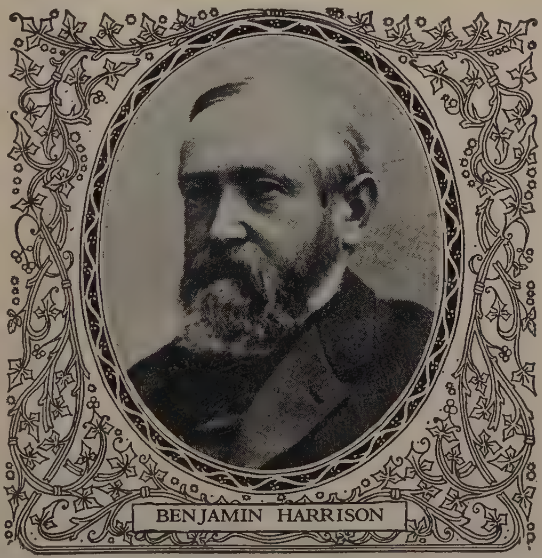
HARRISBURG, PA. In the eyes of strangers, the sumptuous state capitol building, with its fine bronze doors, its sculptures by George Grey Barnard, its mural decorations by Edwin A. Abbey, John W. Alexander, Violet Oakley, and other noted painters, and its decorative tiles and stained glass, is Harrisburg's greatest point of interest. It is one of the finest statehouses in America; on which was spent the huge sum of $13,000,000. But to the citizen of Harrisburg the city's chief pride is not this notable and beautiful building, but the remarkable civic improvements which have given it the name of "Model City."

At the beginning of the 20th century Harrisburg was a prosperous but dirty manufacturing town, supremely ugly and sublimely content. Did not its railroad roundhouses and repair shops, its car works, machine, boiler, and boot-and-shoe factories, its lumber, tin, and rolling mills, its nail works, typewriter factories, and blast furnaces, bring in ever more money? Why worry about trifles like dirty streets, lack of playgrounds, impure drinking water, and typhoid rates?

Then in 1900 the city underwent a change of heart, and in 12 years' time an outward change as well. By a concerted movement of all its citizens, pure filtered water was secured, scores of miles of streets were paved, and a splendid chain of parks and playgrounds was acquired—in short, Harrisburg became a city worthy of its beautiful situation in south-central Pennsylvania on the broad Susquehanna River, with the Blue Ridge Mountains about ten miles away. The city's annual water fête, "Kipona," celebrates the achievement, which is all the more memorable because attained at very slight increase of taxation and without the faintest taint of graft or extravagance. Population, over 75,000.

PRESIDENT *and Grandson of a* PRESIDENT

Descendant of a Family of Patriots—The 23rd Occupant of the White House



BENJAMIN HARRISON

HARRISON, BENJAMIN (1833–1901). Benjamin Harrison, who was President of the United States from 1889 to 1893, was not a politician of the "glad hand" sort. Though he was a brigadier-general of the Civil War, and had long taken an active part in Indiana state politics, he had held only two political offices before becoming president. One of these positions, that of reporter of the Indiana supreme court, was strictly a legal position; and the other office, that of United States senator for six years, 1879 to 1885, had not brought him national fame. Indeed, President Harrison was not a very interesting personality. He was short and stocky, with a neck so short that his head appeared to be set squarely on his shoulders. As he always held his chin back, he was frequently compared by the irreverent to a pouter pigeon. Also his tone and manner were cold. To strangers and even to political friends he appeared almost ungracious. Those who talked with him were met with a frigid look from two expressionless steel-gray eyes; and their remarks were frequently answered in a few short words without the slightest note of interest. In spite of his coldness of manner, however, Harrison could make a good public address. One who knew him well once said: "Harrison can make a speech to 10,000 men, and every man of them will go away his friend. Let him meet the same 10,000 men in private, and every one will go away his enemy."

You may wonder why, with these drawbacks, Harrison was elected president. There were several reasons. In the first place, he possessed a distinguished ancestry. His great-grandfather, Benjamin Harrison, had been a signer of the Declaration of Independence. His grandfather, William Henry Harrison, was a noted Indian fighter and became the ninth president of the United States. His father, though not especially distinguished, had served in the United States Congress for two terms. His own training was such as not to interfere with his availability. His first education was obtained in a log schoolhouse in Ohio, for he was born at North Bend, in the Buckeye State. Then a private tutor prepared him for Miami University (Oxford, Ohio) from which he was graduated in 1852. He was admitted to the bar in 1853, and began the practice of law in Indianapolis, Ind., in the following year.

A second reason why he was nominated by the Republicans for the presidency was that he had fought in the Civil War. His military exploits did not fire the popular imagination, as did those of his grandfather, but still he had served with distinction in the campaigns in Kentucky and Tennessee, and in Sherman's march on Atlanta; and in 1865 he had been appointed a brigadier-general of volunteers, for "ability and manifest energy and gallantry in command of a brigade."

A third reason—and probably the most important—was that he was one of the most prominent Republican lawyers of Indiana; that he had represented that state in the United States Senate, and that the votes of Indiana were considered necessary to obtain a Republican victory. With Harrison as the candidate for president, the Republicans chose Levi P. Morton of New York for vice-president.

ADMINISTRATION OF BENJAMIN HARRISON
1889–1893

James G. Blaine, Secretary of State.

"Reed rules" adopted in the House (1890).

McKinley Tariff Act, Sherman Anti-Trust Act, Sherman Silver Purchase and Coinage Act passed (1890).

Pension expenditures greatly increased.

North Dakota, South Dakota, Montana, Washington, Wyoming, and Idaho admitted as states (1889–90).

Territory of Oklahoma opened to settlement (1889).

First Pan-American Conference held in Washington (1889–90).

Bering Sea controversy with Great Britain settled (1893).

Controversies with Italy (Mafia troubles), with Germany (over Samoa), and with Chile.

Reciprocity treaties with Spain and Brazil.

Annexation of Hawaii fails.

People's Party (Populists) organized (1891).

Harrison defeated by Cleveland for reëlection (1892).

Election Won on the Tariff Issue

The chief issue in the election in 1888 was the tariff. The Democrats who were then in power with President Cleveland were advocates of a lower tariff, while the Republicans stood for a high tariff to protect home manufacturers. John Wanamaker, the foremost merchant of Philadelphia, was campaign treasurer for the Republican party. He appealed to the big manufacturers of the country for money to carry on the campaign, and larger sums were spent in this campaign than ever before, setting a precedent which later caused much trouble to the party.

Harrison won a majority of the electoral votes, although Cleveland, the Democratic candidate, obtained a majority of 100,000 in the popular vote. As the tariff had been the question on which the election was carried, a tariff bill was soon drawn up by Congressman William McKinley, later president of the United States, and was eventually passed. This McKinley Tariff Act provided for higher duties on most manufactured articles brought into the country. That it was not approved by the people was shown by the result of the next presidential contest, in which ex-President Cleveland was reëlected.

The contributions of large corporations to the campaign funds helped to stir up the people against the power of "big business." This hostility was expressed in the Sherman Anti-Trust Act, which forbade corporations to combine so as to control the output of any commodity, and so establish a monopoly. Another law, also drawn up by Senator John Sherman of Ohio, was the Sherman Silver Act, which provided for the purchase by the government of a large quantity of silver each month. This was done to satisfy the people of the West, especially Colorado, who were large producers of silver and opposed the single gold standard in the monetary system.

Clash over Samoa

The chief interest in Harrison's administration, however, centered in foreign affairs. At one time the United States almost came to war with Germany. After Germany had acquired a strong position in Europe by the Franco-Prussian War of 1870–71, it began acquiring colonies and resolved to seize the Samoan Islands, in the Pacific Ocean, regardless of the rights of the natives and of English and American traders. The British author, Robert Louis Stevenson, who was living in Samoa, has left us an account of the haughtiness of the Germans. The United States, England, and Germany all sent war-vessels to the islands, and at one time a terrific hurricane was the only thing which prevented the German and American vessels from fighting. In the negotiations which followed, Germany gave up its claims to exclusive rights in the islands, which were then divided among the three countries.

The Americans thus gained their point with Germany. In a controversy with Great Britain over the killing of fur-seals in Bering Sea, they were not so successful. The breeding place of these seals was the Pribilof Islands, an American possession off the Alaskan coast, and the indiscriminate killing at sea threatened to exterminate these valuable herds. The Secretary of State, James G. Blaine, claimed among other things for the United States and Russia the sole right to fish or kill seals in those waters, on the ground that the Bering Sea was a "closed sea" (*mare clausum*) in international law. But when the matter was submitted to arbitration, the court decided that the United States and Russia could claim the exclusive right only within three miles of their shores, and that anyone could fish or seal outside that limit.

Complications also arose with the Italian government, and with that of Chile. In New Orleans a band of Italian criminals (members of the "Mafia" secret society) were arrested, but a jury failed to convict them. On the night after the trial a mob broke into the jail and lynched the Italians. Italy asked that the leaders of the mob be punished, but the American system of government allowed only the state of Louisiana to do that. As that government gave Italy no satisfaction, she withdrew her representative from the United States. Finally Congress voted to give the families of the murdered men $25,000 each, and the Italian government was satisfied.

The difficulty with Chile likewise arose from the action of a mob, but this time it was a mob of Chileans which attacked some American sailors in Valparaiso. The United States demanded an apology and after a bitter struggle Chile was forced to give it.

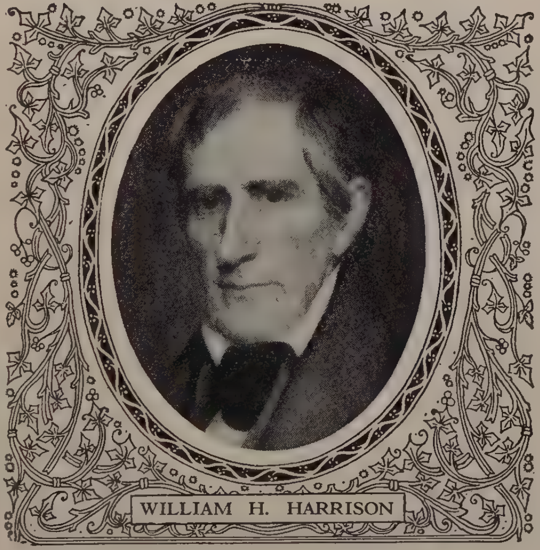
Election Lost on the Tariff Issue

The affairs in Chile and in Samoa are the first indications of America's desertion of her old policy of isolation and her adoption of a world policy. But internal affairs still occupied chief attention, and it was the tariff which gave the election to Cleveland in 1892, after Harrison had served but a single term.

Harrison's fame as a lawyer was much greater than his reputation as a president, and in 1898 he represented Venezuela in the settlement of her boundary dispute with Great Britain. The next year he was one of the representatives of the United States at the Hague Peace Conference. He died March 13, 1901, in Indianapolis after a brief illness.

The INDIAN FIGHTER *Who Became* PRESIDENT

HARRISON, WILLIAM HENRY (1773–1841). If the frontier creates the characteristics which are peculiarly American, as has often been asserted, then William Henry Harrison was a typical American, for most of his public career was spent in the frontier wilderness of the Northwest Territory, or representing that region in Washington. But by birth and education General Harrison belonged to the aristocracy of Virginia. His father was a plantation owner in the tidewater region, who had taken a prominent part in Virginian politics during the Revolutionary War, and had signed the Declaration of Independence. After placing his signature to that immortal document, it is said that he remarked to Benjamin Franklin, "Now we must all hang together." "Certainly," said Franklin, "for you may be sure that if we don't, we shall all hang *separately!*"



The Hero of Tippecanoe, who was the ninth president of the United States and the first president to die in office. His administration lasted exactly one month, from March 4 to April 4, 1841.

As William Henry was the third son of the Harrison family, and the father's property would under the Virginia law of that time go chiefly to the eldest son, a profession was necessary for him. His father sent him to Hampden-Sidney College, Va., 1787 to 1790, and then to Philadelphia to study medicine. But the young man disliked this calling, and at the death of his father, in 1791, he dropped it. President Washington then appointed him an ensign in the army.

Harrison's first active duty was under General Anthony Wayne, in the campaign in the Ohio country against the Indians. He served with distinction in the battle of Fallen Timbers, in 1794, and then was commander of Fort Washington, in Pennsylvania, until 1798.

In 1798 Captain Harrison (as he had then become) resigned his commission in the army, and settled on a tract of land at North Bend, about 16 miles from Cincinnati. That same year President Adams appointed him secretary of the Northwest Territory under Gen. Arthur St. Clair as governor. This was the beginning of an official connection with the Northwest Territory, in which he served as delegate to Congress, as governor of "Indian Territory" after its formation (in 1800) and as superintendent of

Indian affairs. He was the first territorial delegate from any territory in the United States Congress. As such he rendered an important service to the people in obtaining a change in the land policy of the government, so that the public land was no longer sold in vast tracts to the wealthy, but in tracts small enough for the poorer settlers to purchase.

How He Won the Title of "Old Tippecanoe"

As superintendent of Indian affairs he made in all 13 treaties with the Indians, securing the cession of large sections of land in the Northwest. Tecumseh, a chieftain of the Shawnee Indians, and his brother the "Prophet" objected to this giving up of the Indian lands, and claimed that the consent of all the tribes was necessary before the cession could be valid. The chiefs, they said, had "no right to barter away the land for a pewter ring or a keg of liquor." The result was a formidable Indian War, in which Governor Harrison defeated the Indians at Tippecanoe, near Lafayette, Ind. (Nov. 6–7, 1811). This victory made Harrison a national hero, and he was admiringly called "Old Tippecanoe." (*See* Tecumseh.)

In the War of 1812, Harrison with the rank of major-general was in supreme command of the forces in the Northwest. He urged the construction of a fleet on the Great Lakes, and, after the victory of Commodore Perry on Lake Erie, Harrison crossed into Canada. In the Battle of the Thames (Oct. 5, 1813) he defeated the British and put an end to the war in Upper Canada.

Because of difficulties with the secretary of war, General Harrison resigned his commission in 1814. In the following years his admiring fellow-citizens sent him to the United States Congress and to the Ohio State Senate, and in 1828 he was appointed minister to Colombia. But within a year he was recalled from the latter position and retired to his farm near North Bend.

His Nomination for the Presidency

In 1836 General Harrison was nominated by the Whigs for the presidency, and though defeated by Van Buren, he succeeded in carrying seven states. In 1840 Harrison was again the Whig candidate against Van Buren, who was seeking reëlection. The campaign of that year marked a new era in American politics. With it began the monster meetings, the carnival pomp, and the doggerel verse which for years after marked presidential elections. One part of Harrison's residence at North Bend was a log cabin covered with clapboards; and at the opening of the campaign one of his admirers said that his table, instead of being served with expensive wines, was supplied with cider. So "log-cabins and hard cider" immediately appeared at all the Harrison meetings. The cry "Tippecanoe and Tyler too" carried the Whigs to overwhelming victory, making Harrison president and Tyler, vice-president. (*See* Tyler, John.)

But the strain of the campaign, and of dealing with the multitude of office-seekers in the months that followed proved too much for General Harrison's strength. Although in apparent good health at the time of his inauguration, he soon fell ill of pneumonia and died on April 4, 1841—just one month after he took office. He was the ninth to hold the presidential office, and the first to die during his official term.

It is useless to speculate as to what sort of a president he would have made. On the one side are those who hold that "he was not a great man, though he lived in a great time, and he had been a leader in great things." On the other hand, it is pointed out that he was one of the best territorial governors ever appointed in the United States; and that there is no reason for thinking he would not have shown on the national stage the same qualities of broad-mindedness, integrity, tact, courage, and resourcefulness that he had displayed in the lesser drama of the frontier.

HARTE, FRANCIS BRET (1839–1902). When Bret Harte caught the spirit of the lawless primitive life of the early California mining camps and put it into his vivid short stories, he did a new thing. He started the American story of local color and atmosphere, which sprang into instant popularity. He knew the life he wrote about for, though he was born in Albany, N.Y., he had lived in California since he was 15, teaching, mining, and setting type. While he was at work in a San Francisco newspaper office he wrote the first of his sketches and was at once promoted to the editorial staff. He became editor of *The Overland Monthly*, in 1868, and contributed to it 'The Luck of Roaring Camp' and 'The Outcasts of Poker Flats', the most famous of his stories of rough western life. Harte had a talent, too, for humorous verse, and the nation laughed at his 'Heathen Chinee', the Chinaman with the "smile that was childlike and bland," who turned the tables on two white men who tried to cheat him at cards:

> Which is why I remark,
> And my language is plain,

says Truthful James, who tells the story—

> That for ways that are dark
> And for tricks that are vain,
> The Heathen Chinee is peculiar.

Bret Harte's fame had spread so far, meanwhile, that the *Atlantic Monthly* asked him to write for it alone. He went east in 1870, lectured awhile on California life, then was sent as consul to Crefeld in Germany, and later to Glasgow, Scotland. His last years, after 1885, were spent in England, where he died. He was the author of many other short stories and one long novel, but his first stories remained the best. He wrote some serious poems, too, of which certain ones deserve a wider reading than they receive.

Bret Harte's chief works were: Stories: 'The Luck of Roaring Camp' (1868); 'The Outcasts of Poker Flats' (1869); 'The Twins of Table Mountain' (1879); 'In the Carquinez Woods' (1883); 'A Phyllis of the Sierras' (1888). Novel: 'Gabriel Conroy' (1876). Poems: 'The Heathen Chinee' (1870); 'East and West Poems' (1871); 'Echoes of the Foot-hills' (1874).

HARTFORD, CONN. Second only to Boston and Plymouth among the New England cities in historic importance, Hartford, the capital of Connecticut, has been called "the birthplace of American democracy." The men who founded it, almost 300 years ago, were applying and carrying further the same religious ideas that brought the Puritans to America; in addition they drew up here the first written constitution that ever created a government—the famous "Fundamental Orders of Connecticut," adopted in 1639.

In the center of the city there still remains the old square, though much reduced in size, which was set apart when Hartford was first laid out as a town in 1637. Here, too, is the old State House, dating from 1794, and until lately used as a City Hall, where the famous Hartford Convention met during the War of 1812. Not far away is a marble tablet marking the spot where stood the storied "Charter Oak."

Many transformations have taken place since colonial days, and today Hartford is famous for its manufactures, for its fine public buildings and business houses, for its beautiful parks, and handsome residences. Hartford is one of the greatest insurance centers in the world. Firearms of all kinds, including machine guns, are manufactured extensively, and it leads the world in the manufacture of typewriters. Machinery of all kinds, rubber goods, knit goods, furniture, and carriages are among other important manufactures, and there is a very considerable trade in Connecticut tobacco.

At the head of navigation on the Connecticut River, Hartford is not only favorably located for commerce, but has a beautiful site, commanding splendid views of the Connecticut valley. A magnificent granite bridge, one of the largest and most massive in the world, spans this wide stream, while the narrow Park River, which flows through the center of the city, is crossed by several bridges. There is a magnificent park system, said to be the largest in proportion to the population of any city in the United States. Set against the greenery of Bushnell Park is the State Capitol, beautifully designed of white marble, and surpassed by few buildings of its kind. Among the famous men and women who have lived in Hartford are Noah Webster, Harriet Beecher Stowe, Charles Dudley Warner, and Samuel L. Clemens (Mark Twain). Trinity College and the Hartford Theological Seminary are its best-known educational institutions. Population, about 140,000.

HARZ (*härts*) **MOUNTAINS.** The deep wooded valleys of the beautiful Harz Mountains abound in quaint old German towns, ruined castles, and fantastic rock masses rich with the romance of many centuries. These mountains lie in west central Germany, between the Elbe and Weser rivers, extending 57 miles to the northwest and averaging about 20 miles in width. The upper slopes are bare of trees but grazing is plentiful. The lower slopes support forests of pine and fir. In the Harz, as in Switzerland, the cattle are driven to the upland pastures in the early spring and left until the winter sets in. Around their necks are bells, harmoniously tuned, which tinkle delightfully as the animals graze in the boundless green meadows. In humble little dwellings propped on the hillsides live the country people, who with loving care breed the valuable Harz Mountain canaries and other songsters of the region.

The highest elevation in the chain is the Brocken, a mammoth dome-shaped mass of granite, 3,745 feet high,—the highest peak in Central Germany. Long after Christianity had been adopted in other sections of Germany, the Broken remained a stronghold of Teutonic paganism. Even today the peasants are filled with heathenish superstitions regarding the spirits that are supposed to haunt this bald bleak dome, and every year on the first day of May queer ceremonials are held to appease the specter.

The climate on the mountain tops is damp and cold, but in summer the temperature of the valleys is delightfully cool and pleasant, making the region a favorite touring ground. The towns are a never-ending source of enjoyment to lovers of history and romance, especially the little city of Goslar, which lies huddled at the northern end of the range. Here is an ancient castle of emperors, built before the year 1050, the oldest castle in Germany still in a state of preservation. Beautiful roads traverse the whole section, making extended walking trips easy, and the old-fashioned inns along the roadside hold a pleasant invitation to the hungry, thirsty, or footsore traveler.

The richest stores of minerals in all Germany lie in these mountains, making mining the chief industry. Veins of lead with a mixture of silver abound, and gold, copper, iron, and sulphur are also found. From the sulphur great quantities of sulphuric acid are manufactured. Marble, granite, and gypsum are also worked. Some of the inhabitants gain a livelihood in the forests, and the lumber is shipped to all parts of the country. Paper is made in the many small towns scattered along the numerous river valleys.

HASTINGS, BATTLE OF (1066). Duke William of Normandy, who claimed the throne of England against King Harold, succeeded in landing his army without active opposition at the town of Hastings, on the English Channel. At dawn on Oct. 14, 1066, he roused his troops and set out on an eight-mile march to attack the English, who had occupied the crest of a steep curving hill. The English were about as numerous as the Normans, and were packed closely together on foot, protected by their great shields. They repulsed attack after attack of the mounted Normans, hurling darts and lances, and using their long-handled battle-axes with terrible effect. A blow from one of these nearly struck William from his horse, but his helmet, though badly dented, saved him.

Toward evening Harold was struck in the eye by an arrow and fell mortally wounded. His two brothers were already slain, and the picked troops who guarded the dragon standard of Wessex were killed fighting to the last. The rest then fled and victory remained with the Normans. Right among the dead where the English standard had stood and where his own now waved, William had his tent set up and his supper brought to him. In after days Battle Abbey was erected there to mark the spot. This battle was the beginning of the Norman conquest of England which won for William the title of "Conqueror" (*see* William, Kings of England).

Many incidents of the battle, together with the costumes and weapons of the fighters, were pictured by Norman needle-women on a famous piece of embroidery known as the Bayeux Tapestry. This interesting relic of the Middle Ages is still preserved in the public library of Bayeux, France.

Hastings is still a thriving English town, with a population of about 60,000.

HASTINGS, WARREN (1732–1818). If it was Clive who laid the foundations of the British power in India, it was his successor, Warren Hastings, who built on those foundations in such a way as to produce the Indian Empire of today.

Born in the same year with George Washington, Warren Hastings was early left an orphan under the care of an uncle who sent him to the famous Westminster school in London. He proved a good student, but his hopes of a university education vanished when his uncle died. A clerkship in the East India Company at Calcutta was obtained for him, and there, like Clive, he arrived at the age of 18. When Suraj-ud-Dowlah marched on Calcutta and committed the Black Hole crime (*see* Clive, Robert), Hastings was at a cotton factory near Calcutta and for a time was held prisoner. When Clive marched against the Indian prince, Hastings joined his force as a volunteer and helped to recover Calcutta. Clive recognized his abilities and made him agent of the Company at the court of one of the native princes.

After 14 years in India, Hastings returned to England in 1764. He was now able to indulge that taste for literature which stayed with him all through his Indian career, and met Dr. Johnson and other London literary lights. But Hastings did not lose touch with affairs in India. Through Clive's influence he was appointed to the governing council in Madras, and then, in 1772—following Clive's retirement and the most terrible famine in India's history—Hastings was sent back to India as governor of the province of Bengal. Two years later the districts of Madras and Bombay were brought under his control and he was made governor-general for the Company in India.

Extension of Britain's Indian Empire

His administration, which lasted until 1785, marks a great epoch in the extension of British rule. In the beginning the East India Company was merely a *trading* corporation, having nothing to do with governing the land outside of its few trading posts. Now it took over in addition the chief work of government in wide stretches of the land—collecting the taxes and maintaining armies, and leaving to the native rulers of those provinces only shadowy power. Elsewhere also the Company undertook to furnish the princes with military protection in return for large money payments.

This was a period of great unrest in India. The Mahrattas, a warlike Hindu people of western India, and other races were planning to seize rich sections of the peninsula. Hastings had to watch the interests of the Company and wage wars for the protection of their territories. Meanwhile the French were plotting in the south with powerful Indian princes. Hastings found difficulty in finding money for these various wars, for many of the princes had failed to pay the sums due for their protection. Hastings accordingly forced the Raja of Benares to pay up, and also collected arrears from a weak prince in Oudh who claimed that his mother the Begum (queen) held all his money. These two debts collected, Hastings had money enough for the war in the rich plains near Madras, where Hyder Ali with a huge army was laying waste the land. After defeating two British generals, Hyder Ali was routed by General Coote, and his French allies driven from the sea by a British fleet.

Hastings tried also to reform the Company's service, which had become corrupt after Clive left India. The word "nabob" (*nawab*) originally meant a rich Indian ruler, but so many English traders and soldiers made enormous fortunes and returned to England to spend their ill-gotten money in cheap display, that the word soon was applied to this type of adventurer. Hastings, who spent his own leisure in learning Persian, tried to get the English agents to study the languages and customs of the Indians. He also sought to open trade with Tibet, and to open communication with Europe along the ancient Red Sea route. He left India with the Company's government firmly and justly administered. He retired in 1785, after finishing Clive's great work.

The Unjust Impeachment of Hastings

Hastings' measures in India naturally had created for him a host of enemies, both among the native princes and among the English. Chief of these was Philip Francis, a member of his council, whom he had wounded in a duel at Calcutta. At home the orator Burke and the playwright Sheridan took the lead in demanding Hastings' impeachment by Parliament. For seven years the trial dragged on, and although it ended in his acquittal the great expense made him a poor man. It is chiefly to Lord Macaulay's essay on Hastings that his critics turn when making charges that he had robbed the Begum of Oudh, and other princely rulers of India. Macaulay, who lived in Calcutta for four years as a council member, could have known the facts, but he took little pains to verify the charges, and these have since been proved false.

Hastings died in 1818 at the manor where his ancestors had lived. His last years brought him many public honors, and he died regretted by a host of Indian and English friends and admirers as one of the founders of the British empire in India.

The Story of HATS *and* HOW THEY ARE MADE

What Endless Variety in the Headgear of Different Peoples!—The History and Geography of Hats—A Visit to a Felt Hat Factory—Why Panamas Cost So Much—Why Men Lift Their Hats to Women

HATS AND CAPS. If we could assemble specimens of the headgear of every land and age on one gigantic hat rack, what an amusing and interesting sight it would make! The fur hood of the Eskimo would stand beside the Mexican's high peaked hat; and between the glossy silk hat of civilization and the huge umbrella-like straw hat of the Burmese would glow the turban of the Mohammedan and the bright bonnet of the Scotch Highlander. The cone-shaped hats of the early Aegean civilization—4,000 years ago—and the tall cylindrical headgear of the Hittite kings and queens would present a fascinating contrast to the cocked hat of Washington's time and the cowboy hat of the western plains. The stiffly wired cap of the Norwegian bride would be there, and the huge flapping fur hat, lined with red velvet and adorned with a great feather, that Charles XII of Sweden wore upon his triumphal entry into the city of Rouen in 1453.

Why such a marvelous variety of forms? Partly to serve particular needs, partly just for ornament. In regions of great heat or intense cold, protection is the first purpose of head covering; but in the civilized countries of the temperate zone, where it is rarely excessively hot, cold, or wet, hats vary greatly in shape, size, and material. Bright colors are common; hats are designed, to a great extent, for decoration; and fashion determines the materials. These materials are gathered from all over the world — straw from the Philippines, Italy, and Japan; rabbit fur for felt from Australia and central Europe; silk from China, Italy, and Japan; fancy furs and feathers from a score of lands. In countries not so advanced, where there is little foreign commerce, the materials used for clothing must be those close at hand, and a headdress once adopted is used for centuries.

In the western world men's hats change from season to season in minor details of shape and trimming, but the principal types have remained unchanged for many years—the straw hat, the silk hat, and the felt hat, the last including the soft hat and the stiff hat or derby. Besides these there are the popular cloth hats, made of woolen or cotton fabrics, stiffened by many rows of stitching and sometimes by shellac. Caps also are largely worn for informal wear.

How Felt Hats are Made

If ever you get the chance, visit one of our great felt-hat factories, and see how your derby or soft hat has grown out of a few scraps of fur from an animal that once scampered over the plains of Australia, Argentina, or Canada. For the finer grades, fur alone is used; but cheaper hats are made from a mixture of wool and fur, or wool alone. The first step is to clean and brush the fur while it is still on the skin and "carrot" it by brushing on nitrate of mercury to make it felt more easily. Then a machine shears off the fur, which passes on an endless belt to blowing machines. In these the soft fluff is torn apart by steel teeth and freed from hairs or foreign material.

Now begins the transformation into a hat. The exact amount of fur needed to make one hat is passed to a boxed-in machine, which contains a minutely perforated copper cone about three feet high. As this cone revolves, myriads of the mistlike fur particles are drawn by suction to its damp outer side, forming a thin covering of felt. A wet cloth is thrown over this matted fur, another cone is pressed over it, and the whole is immersed in a tank of hot water until it felts under the pressure. The delicate cone of felted cloth is then shrunk to the proper size, dyed, and given a bath of shellac to stiffen it—weak shellac for soft hats, and a denser solution for stiff hats. The cone is now plunged in boiling water and flattened at the crown, so that it begins to take on the appearance of a hat. It is stretched, blocked, and pulled with the aid of hot water, steam, and ingenious machinery, until it has taken the desired form. Stiff hats are put in a hydraulic press to increase their rigidity, and the brim is curled by being pressed on a flange by a bag of hot sand. The rough surface is smoothed by rubbing with emery paper, the trimming is put on, and last of all the leather sweat-band attached—and the hat is ready.

Straw Hats, Felt Hats, and Women's Hats

Straw hats are made from carefully prepared imported straw. The braids, except in some of the finer grades, are sewed and pressed into shape by machinery, after being sized with waterproof gum. Panama hats are made from a very fine light "straw" (*toquilla*) obtained from the leaves of a shrub that grows chiefly in Ecuador, though it is also found in Colombia and the forests of the upper Amazon. The best hats take five or six months to complete, since the fibers must be kept thoroughly moistened and the weaving is done only in the late twilight or early dawn.

In the manufacture of silk hats several layers of cotton material are cemented together with shellac. This "body" is pressed into shape on a block, and the rim is cemented to it. Then it is coated with shellac, covered with silk plush, trimmed, and finished.

The manufacture of hats and caps is an important industry in the United States, centering in New York and Philadelphia, although there are large hat factories in Orange and Newark (N.J.); Danbury, Bethel, and Norwalk (Conn.); Brooklyn (N.Y.), Reading (Pa.), and in many other industrial centers.

The manufacture of women's hats is not so centralized, although the largest factories are in New York City, and many of the felt hats are made at the same factory where men's hats are manufactured. Artificial flowers, feathers, and ribbons for trimming are imported in great quantities. Most women's hats are made by covering frames of wire or buckram with various fabrics.

Some Curious Facts about Hats

Did you ever notice the tiny bow that decorates the lining or inner band of most hats, both men's and women's? Not so very long ago, hats were made in only a few sizes, and a drawstring was inserted in the lining, which was tightened or loosened to fit the head. The little bow is a relic of that old practice, although it also serves the purpose of marking the back of the hat. Nearly all these bows are made in Geneva, Switzerland.

The ancient Greeks, when traveling, protected their heads with a flat, broad-brimmed hat of felt which tied under the chin and hung down the back when not needed, like a sunbonnet of today. These tie strings are still preserved in the streamers around the crown of a child's sailor hat.

STORY OF THE LITTLE BOW

The little bows inside men's hat bands are relics of the drawstring used in olden days to make hats fit.

During the 14th and 15th centuries, women's hats, caps, and hoods were of the most extravagant shapes and sizes. Some were horned, others were great peaks, like the "dunce-cap," from a foot to three feet in height. Sometimes a veil would be draped over these towering structures, falling the length of the dress.

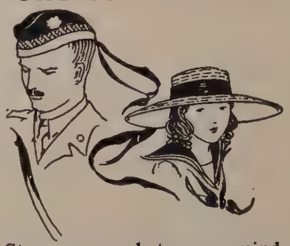
Hats have often had an important place in distinguishing sects and parties. The Puritan wore his severe high-crowned hat over his cropped head as a rebuke to the cavalier of the time, with his hair in curls, and a great sweeping plume on his low-crowned hat. The Quaker affected a broad-brimmed gray hat (still to be seen in some conservative communities) which he refused to doff to any man—only to his Maker. In the Roman Catholic and Anglican churches hats and other forms of headgear have a conspicuous place in the differences of costumes which distinguish various ranks and orders of the clergy. During the greater part of the 18th century, two rival political parties in Sweden, known as "Hats" and "Caps," were in constant struggle, the "Hats" representing the nobles, and the "Caps" being the party of the common people. These names were slogans in some bitter battles.

THE ANCIENT HAT BAND

The old Egyptians wore a band to keep their hair in place. We have kept the band but put it on the outside of our hats.

In the English House of Commons members may wear their hats while seated, but take them off when they rise to speak. But in one special case—after a debate has been closed and a vote ordered, but before it is actually taken—a member who wishes to raise a point of order must speak seated and with his hat on. The great Gladstone once ran foul of this custom. He had wandered away from his seat bareheaded, and wished to speak on a point of order as a vote was about to be taken. "Hat! hat! hat!" cried the members in riotous glee as he started to speak. A nearby member lent him a hat, but it was several sizes too small for Gladstone's massive head. With this perched ridiculously atop his head, the "Grand Old Man" was allowed to proceed. This incident illustrates only one of many points of etiquette regarding the hat in the House of Commons. The session is dismissed when the Speaker (the presiding officer) rises and puts on his hat.

THE STREAMERS



Streamers on hats are reminders of the tie strings on the ancient Greek traveling hats.

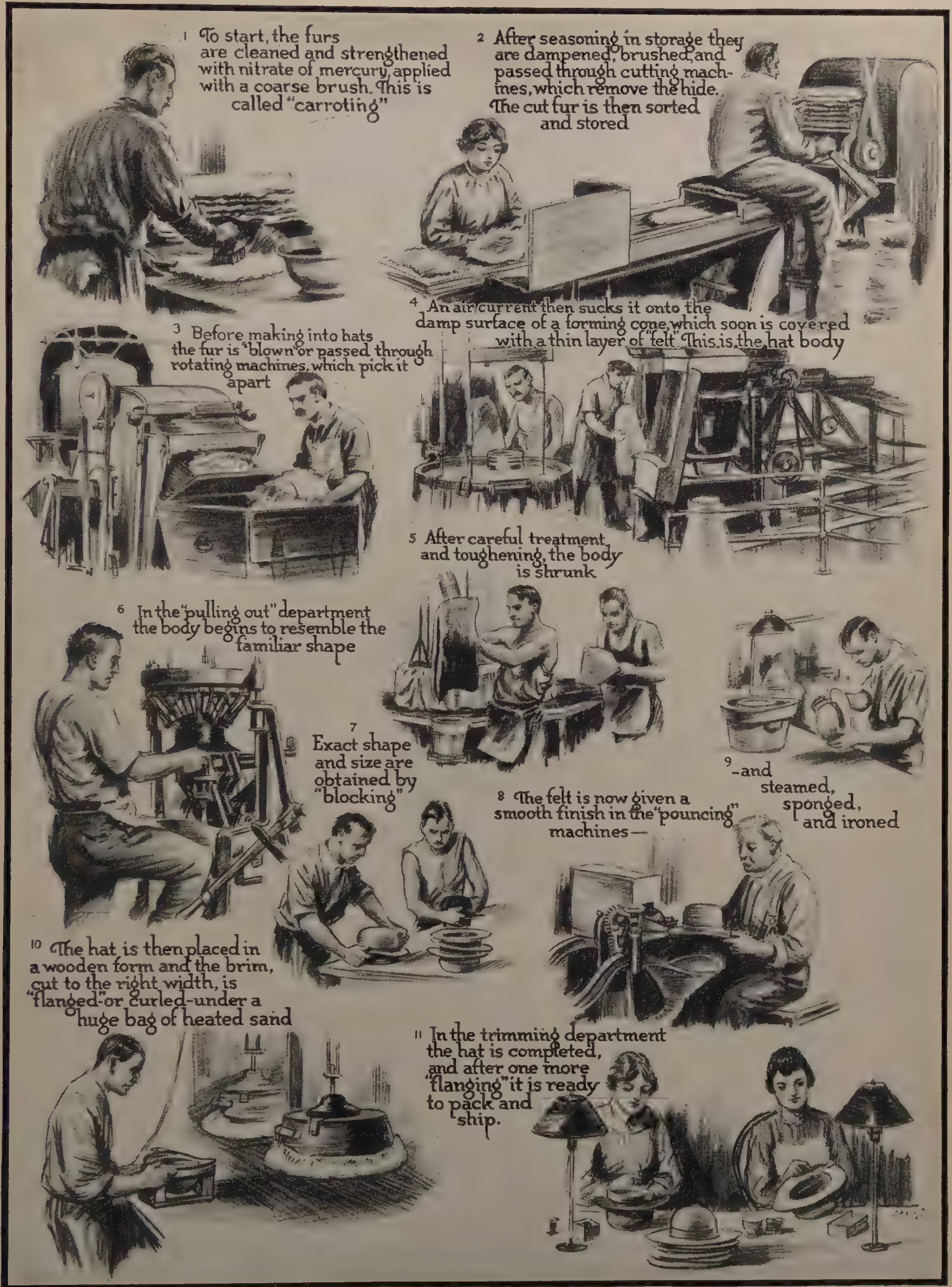
Formerly inferiors were required to uncover in the presence of superiors as a mark of respect. Today this custom survives chiefly in the custom of removing the hat in the presence of royalty and other distinguished persons, and of raising it to ladies while out of doors.

Havana, Cuba. A blinding tropical sun beats down upon the narrow white pavements, palm-fringed baseball park, glaring marble palaces, modern office buildings, old gray churches, and gay-colored Spanish houses of Cuba's capital. It blazes upon the concrete docks and forests of masts along its teeming water front, and brightens its background amphitheater of palm-fringed hills.

This is Havana—a city that has truly been called "Spain with a modern American virility, tinged with a generous dash of the tropics." It is, on the one hand, a quaint city of plazas, bazaars, cafés, and lottery, cigar, and wine shops; a city where the boom of ancient cathedral bells mingles with the clang of cart bells and the cries of street vendors as they press their way in and out of old market places piled high with tropical fruit, vegetables, and many-colored fish, and wander down cobbled lanes here and there topped with canvas canopies and edged everywhere by one-story plaster-faced houses with balconies, flat roofs, jutting iron-barred windows, and arched doors leading to dim *patios* or courts.

On the other hand, Havana is curiously modern, with a distinct American flavor. Baseball is now a well-accepted substitute for bull fights and a pretext

ELEVEN STEPS IN THE MAKING OF MEN'S HATS


1 To start, the furs are cleaned and strengthened with nitrate of mercury, applied with a coarse brush. This is called "carroting"
2 After seasoning in storage they are dampened, brushed, and passed through cutting machines, which remove the hide. The cut fur is then sorted and stored
3 Before making into hats the fur is "blown" or passed through rotating machines, which pick it apart
4 An air current then sucks it onto the damp surface of a forming cone, which soon is covered with a thin layer of "felt" This is the hat body
5 After careful treatment and toughening, the body is shrunk
6 In the "pulling out" department the body begins to resemble the familiar shape
7 Exact shape and size are obtained by "blocking"
8 The felt is now given a smooth finish in the "pouncing" machines—
9 -and steamed, sponged, and ironed
10 The hat is then placed in a wooden form and the brim, cut to the right width, is "flanged" or curled-under a huge bag of heated sand
11 In the trimming department the hat is completed, and after one more "flanging" it is ready to pack and ship.

The pictures tell the story of a man's felt hat from the raw fur to the finished product for as much betting; "jitney" automobiles, which are for hire everywhere, compete with clanging street-cars in mad rushes up and down the narrow old streets. The uniform of the khakied Cuban soldier is American and so too are the bill-boards, the electric signs, and the mail boxes. At all points there is thus a curious dovetailing of the old and the new. Office buildings, theaters, hotels, and clubs shoulder crumbled Spanish churches; the latest factory products are found in quaint old-time markets; modern ferries chug across the harbor beside queer old row-boats with awnings at the rear; old convents have been transformed into post-offices and homes of warehouse brokers and customs officers.

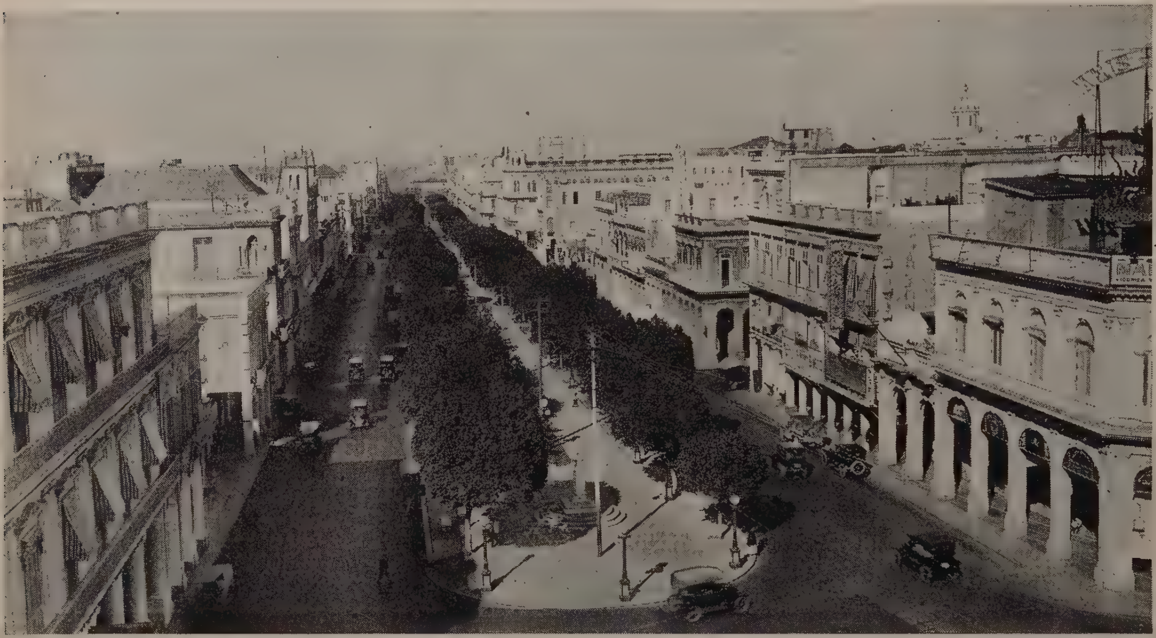
Havana is the largest and most important commercial city in the West Indies, a city of busy factories, banks, and stores of all description. Its railways shoot out to every important island center. At its doors is one of the safest harbors of the world, where 4,000 ships enter every year flying flags of many nations and laden with cargoes from the United States, Spain, and South America. These same ocean-going vessels then fill their holds with cigars, tobacco, and sugar, three-fourths of which goes to the United States. Havana possesses some of the largest cigar and tobacco factories in the world, although she makes other things, too, such as boxes, barrels, wagons, and carriages.

And last of all there is the Havana that the tourists so admire, the city famous for its promenades edged by mansions of the planter aristocracy, for its public gardens, university, and its drives—such as the beautiful Prado, with its double row of laurels and other shade trees and graceful palms running along a parkway in its middle; a city noted for its old cathedral dating back to 1724, where until 1898 the body of Columbus was said to have remained; for the picturesque old forts of Morro Castle, La Cabana, and Punto Castle, that guard the entrance to its harbor; for the Governor's fine palace; and for the many seaside resorts near by.

In the older parts, Havana is still rather neglected looking, although it is much cleaner and more sanitary than it was before the United States military occupation in 1898, when the Americans helped to clean it up and eradicate its yellow fever. The newer portions of the city are modern, picturesque, and well laid out.

Havana is situated on the north coast of Cuba on a sort of peninsula between the Gulf of Mexico and the land-locked harbor. It was founded by Velasquez in 1519. It remained the chief city of the Spanish power in the West Indies till near the end of the 19th century. In February 1898 the United States battleship *Maine* was blown up in its harbor, and during the Spanish-American War that followed, the city was blockaded by the United States fleet. With the emancipation of Cuba from Spanish rule, Havana became the capital of the new republic. Population, about 365,000.

LOOKING DOWN THE PRADO IN HAVANA



The most attractive street in Havana is the Prado, down which we are now looking. Beginning at Punto Castle, it runs along the line of the former city walls to the Parque de Colon. It is, as you see, a very wide and handsome promenade and it is lined with fine buildings and club houses, most of them built from the limestone which underlies almost all the island. As in most cities in warm climates, the houses are low, rarely rising above three stories. Notice how the upper stories project over the sidewalk, providing a grateful shade for pedestrians.

HAVRE (*äv'r'*), **FRANCE.** Cities, like people, have personalities. Some are interesting and full of romance and color; some are just good work-a-day necessary places, but not very interesting. Havre, to which the French add an article, making it Le Havre ("the Harbor"), is such a work-a-day city.

But it is an important city, for its location at the mouth of the Seine River makes it the second seaport of France. Many big steamers come and go from here, and most of the French people in America have come through Le Havre. The town has nine immense harbor basins with eight miles of quays lined with warehouses. It is a very prosperous place, largely because of its ship-building yards, its sugar refineries, and its cotton trade.

Havre is quite a new town as French towns go, though it would be very old for America. It gained its first importance under Francis I, in 1516, who fortified it to use as a naval base in his wars against England. He could not foresee that in the World War of 1914–18 many thousands of British troops would pass through it to help France, and that France would be only too happy to have them come. Population, about 140,000.

A PARADISE of the PACIFIC

We are looking here across a Hawaiian rice field. It occupies a low-lying terrace near the coast which has been flooded by the rice growers. In the distance are some of the rough volcanic hills which cover the interior of the islands. The land is remarkable for its varied scenery and luxuriant vegetation.

HAWAIIAN (*hä-wī'yăn*) **ISLANDS.** In mid-Pacific, 2,000 miles away from any important land mass, lies this lovely group of islands flying the United States flag. They lie nearly all in single file, extending from northwest to southeast—eight inhabited, and a dozen tiny rocky ones unpeopled; but together they comprise an area less than that of New Jersey, with a population about equal to that of Jersey City. The strategic value of the islands to the United States is very great. Lying within a six-days' steaming distance of San Francisco, this "cross-roads of the Pacific" affords a point from which the whole North Pacific Ocean can be patrolled by cruisers, and the commerce of the Panama Canal be protected.

Extent.—Length of island chain, about 400 miles. Total area, 6,449 square miles (island of Hawaii, 4,015 square miles). Distance from San Francisco, 2,100 miles; from Yokohama, 3,400 miles. Population (1920 census), 255,912.

Natural Features.—Islands of volcanic rock rising to mountain peaks from 15,000 feet below the sea and fringed with coral reefs. Highest peak, Mauna Kea, 13,823 feet; Kilauea, the second greatest active volcano in the world. Climate semi-tropical, the latitude being about that of Cuba.

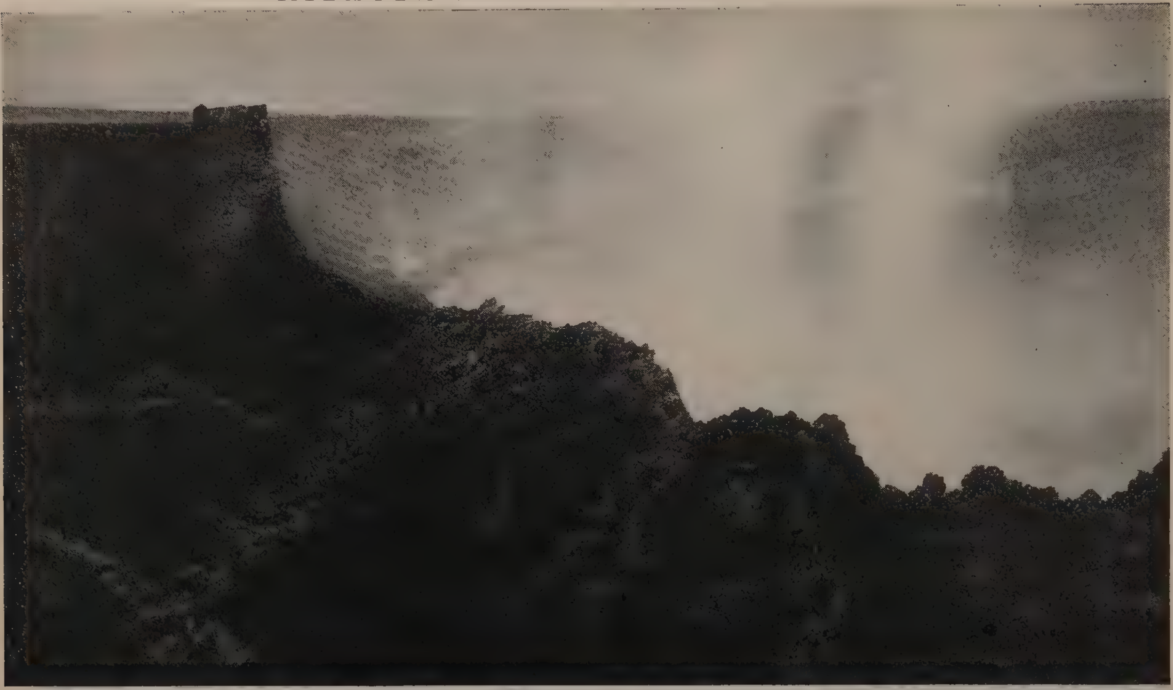
Chief Products.—Cane sugar, canned and fresh pineapple, rice, coffee, sisal hemp, hides, and honey.

Cities and Harbors.—Honolulu (capital), population, about 84,000. Other important harbors are Pearl Harbor and Hilo Bay.

The Hawaiian Islands are really the tops of 15 or more enormous volcanoes which have been built up from the bottom of the ocean. Hawaii, the largest and most southerly island, consists of five volcanic mountains which have encroached upon one another by their eruptions. Several islands, like Maui, consist of "volcanic twins" united at the base, while others are built around a single cone. There are now no active volcanoes except on Hawaii; but all the islands are mountainous, in many places rising from the sea in sheer cliffs hundreds and even thousands of feet in height. The valleys are remarkable for their beautiful scenery, the swift short rivers having cut many deep ravines and picturesque gorges, some of which almost rival Yosemite.

Nowhere will you find a more healthful and delightful climate than in this Paradise of the Pacific. Cooled in summer and warmed in winter by the

KILAUEA AND ITS LAKE OF FIRE



A vast kettle of molten rock—that's what the crater of Kilauea is! You see the walls are brilliant with the reflection from this fiery cauldron. The oval crater is nine miles around. The lava rises and falls great distances. When this picture was taken it was only 400 feet from the surface and overflowed three weeks later.

ocean winds, it is seldom too hot and never cold, and the temperature is about ten degrees lower than in other lands of the same latitude. Owing to the northeast trade winds, the islands are well watered on their northern side, the rainfall amounting in some places to 250 inches a year. The southern slopes, however, are almost arid, especially in Hawaii, and crops are grown under irrigation. The decomposed lava rock makes a rich deep red earth most favorable to agriculture, and the more important islands contain considerable areas of this fertile soil.

As your ship steams into the beautiful harbor of Honolulu, the capital, on the south coast of Oahu, you look out over a crescent-shaped beach fringed with coconut trees, and the white and pink roofs of a town almost hidden in luxuriant foliage. Behind it are yellow-green cane fields, and in the distance the misty bluish-purple of the mountains. The harbor is crowded at all times with Japanese and Hawaiian fishing boats, ocean liners, and the tramp freighters that bring manufactured goods to the islands and return to the States with sugar, coffee, and fruit worth more than $50,000,000 in a single year. Near the dock the water is alive with brown-skinned boys swimming about and shouting, ready to dive for coins which the passengers throw into the water. If it were not for its tropical setting and its unusual population, Honolulu about the harbor would look very much like any small American city; for its government buildings, cable and wireless stations, street-cars, electric lights, and telephones are all like those of the United States. It has wide streets and fine parks, hotels, clubs, schools, and churches, and one of the finest aquariums in the world. But outside of the business center, luxuriant gardens with tropical flowering trees everywhere border the streets, and Europeans and Americans are few compared to the thousands of picturesque Orientals and mixed-blooded Hawaiians. There is a "Chinatown," where the streets are lined with queer little shops and filled with gaily clad Chinese men, women, and children. At other places you find Hawaiian girls sitting on mats on the sidewalk, making and selling wreaths and ropes of flowers ("leis") which the Hawaiian women wear upon their heads and about their necks. They are dressed in bright-colored "holokus,"—wide "Mother Hubbard" dresses, which the early missionaries devised for the scantily clothed natives, and which are still worn today. Everywhere one meets the Japanese (who compose nearly half the population of the islands), returning from the sugar

WHY HE LOOKS THAT WAY

What an ugly expression! It's because this feathered mask represents the ancient Hawaiian God of War.

mills or from their work in the fields, or selling fruit suspended in two baskets from a bamboo pole.

Six miles west of Honolulu is Pearl Harbor, a United States coaling and naval station, and one of the finest land-locked harbors in the world. On its flat eastern banks stand government buildings, barracks and shops, and a great dry dock; and in the water you may find gray battleships and cruisers, resting for a day from their voyaging in the Pacific. By dredging the channel, which was barred by a coral reef, Pearl Harbor has been made available for the largest vessels now afloat.

A LITTLE KANAKA

This is a young native of Hawaii or a Kanaka, as he is called at home. His race, once one of the sturdiest in the Pacific, is fast disappearing. Kanakas have reddish-brown skin, dark hair, large expressive eyes, and very white regular teeth.

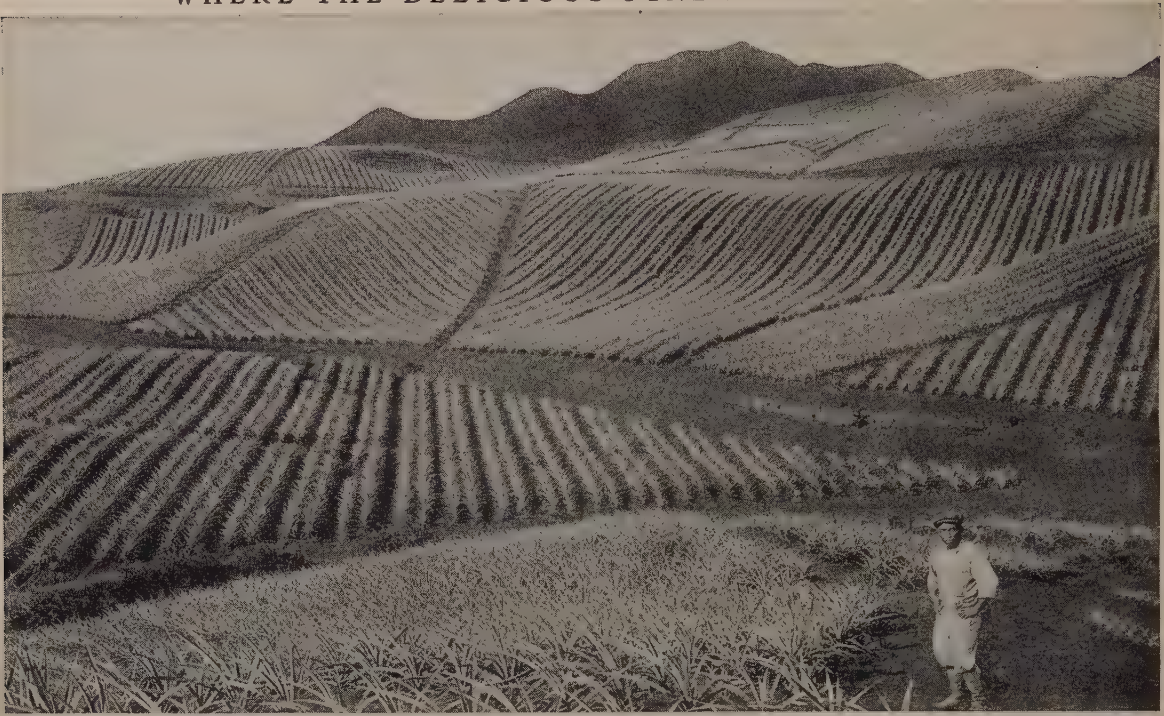
THE CITY AND THE SEA

The central picture shows a scene in Honolulu, the capital of the islands. The streets are wide and paved with crushed lava. Below is a view from the beach. One of those skillful surf riders is coming in standing on his board. When the surf is high they go at the rate of 40 miles an hour.

A trip on the railway that follows the narrow coast around Oahu takes you through a sea of waving plumes that make up one of the many large sugar plantations spread over the lower slopes and valleys. Sugar forms almost nine-tenths of the exports of the islands, which have the largest yield per acre in the world. On the more elevated lands are great fields of pineapples, which in value constitute the islands' second industry. This fruit is famed for its delicious flavor, and is exported, raw or canned, to all parts of the world. There are also fields of sisal hemp, each plant looking like a rosette of spears; and "algaroba" forests (a species of locust) where the bees are kept that supply tons of honey to England each year. Everywhere we go we notice little "taro" patches, and often see men and women working in them, standing up to their knees in water. The beetlike root of this plant, after being baked, pounded, and mixed with water, forms a thick fermented paste called "poi," which is the principal food of the islanders.

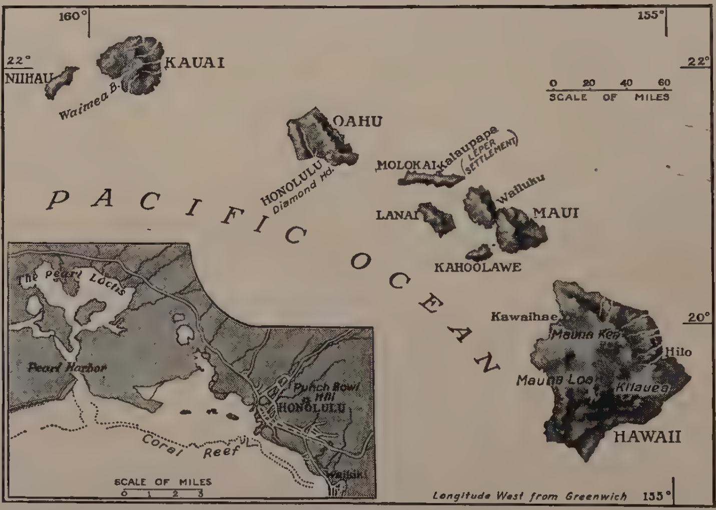
From Oahu, the third of the islands in size but the greatest in population and wealth, a coast steamer will take you south to Hawaii, which is larger than all the other islands together. On the way you pass the island of Molokai, famous for its leper settlement on a jutting peninsula in the north, and Maui, the second island in size, with some of the most important plantations. You pass also Kahoolawe and Lanai, small islands given over entirely to cattle- and sheep-raising. Finally the coast of Hawaii comes into view, and you disembark at Hilo, a little city of about 10,000 people, the island's only port. Beautifully situated on a broad smooth bay with two superb mountains in the background and luxuriant tropical gardens throughout the town, Hilo has many attractions that fully compensate for its reputation of having rain "eight days in the week."

WHERE THE DELICIOUS PINEAPPLES GROW



After you have passed through the large sugar plantations on the lower slopes and in the valleys of the Hawaiian Islands, you come on the more elevated lands to these vast fields of pineapples. The pineapples of Hawaii are especially noted for their delightful flavor and are exported, raw or canned, to all parts of the world.

THE "CROSS-ROADS" OF THE PACIFIC



This map shows the Hawaiian Islands stretching 400 miles across the mid-Pacific. The inset shows Honolulu, and Pearl Harbor six miles away. Formerly the coral reef was continuous, but the bar at the entrance of Pearl Harbor was removed and the harbor is now a naval station, one of the important strategic points guarding the Pacific coast of the United States.

The entire island has much to charm the sightseer in its snow-capped mountains and tangled tropical forests, its deserts and sparkling water-falls, its lava flows, and its plantations of coffee and sugar; but it is chiefly for its marvelous volcanoes that thousands of people visit Hilo each year. Not only is Kilauea the second greatest active crater in the world, but it is one of the most unusual. On its great lake of molten lava, waves of fire toss and battle with each other, and dash against the black sides of the pit, making a brilliant spray. Yet Kilauea, like Mauna Loa and the other active craters, is excellently behaved, having thrown out neither stone nor ashes since it destroyed the army that was marching against King Kamehameha 150 years ago. When lava does break out far up on the uninhabited slopes, it cools as it runs and so approaches the sea only at the rate of a few yards a day.

Returning to Honolulu, a coast steamer will take you north to Kauai, called the "Garden Island" because of its prosperous plantations of sugar, rice, and pineapples. It was here that Captain James Cook first stepped on Hawaiian soil, in 1778. The people thought him and his crew supernatural beings, and sent messengers in the swiftest canoes from end to end of the island with word of the strange visitors. The next year Captain Cook lost his life in an attack by the natives while he was attempting to recover a stolen boat (*see* Cook, Captain James).

Cook called the islands the "Sandwich Islands" after his patron, John Montague, the fourth earl of Sandwich, the head of the British Admiralty office; but "Hawaii," the name used by the natives, is the one by which they are now known. Although not the first white man to visit the islands, Captain Cook's famous journals first made their geography known to the civilized world. The islands were then governed by chiefs who constantly waged war against one another. Shortly afterward (1795) they were all united under the famous King Kamehameha I, whose descendants reigned for almost 100 years. Many missionaries came to the islands from America and Europe, the first being sent from Boston in 1820, and through their efforts the people were taught reading and writing and converted to Christianity. In 1893, when Queen Liliuokalani attempted to abolish the constitution which King Kamehameha III had been forced to give to the people, a revolution took place. The queen was deposed and application was made for annexation to the United States. President Cleveland, however, withdrew the annexation treaty from the Senate when he took office, on the ground that the United States diplomatic representative, backed by marines landed from a naval vessel, had improperly aided the revolution. Hawaii was then organized as a republic, in 1894, with Sanford B. Dole, as president. Four years later, when the Republican party again came into power with President McKinley, an annexation treaty was concluded. The islands now form the Territory of Hawaii, with a governor appointed by the President of the United States, a territorial legislature, and a delegate to represent the territory in the United States Congress.

The native Hawaiian population has greatly decreased since the introduction of new diseases and new methods of living by the whites, so that they now form only one-sixth of the total population. The Japanese are by far the largest element, and there are also many Chinese and Filipinos. The Americans and Europeans form one-fifth of the population. Most of the dark-skinned whites are listed as Portuguese. All Hawaiian citizens, including Asiatics, also possess the rights of United States citizenship.

The primitive customs of the Kanakas, or native Hawaiians, have largely disappeared, along with the grass huts of early days and the old religious beliefs. Most of the natives live in wooden houses, and some have fine homes. English is the prevailing language. Like all the Pacific Islanders, the Hawaiians are a musical people, and in recent years "Hawaiian music" has had a wide popular vogue.

HAWK. Until recently all hawks had the ill-will of every farmer and sportsman because of the havoc which some members of this large group work among poultry and other birds, but careful study has shown that all but three species do more good than harm, by destroying enormous numbers of small rodents and insects that are harmful to grain, fruit trees, and birds. The true bird-killers and the only ones that deserve the name "hen-hawks" are the sharpshin hawk, Cooper's hawk or the blue-darter, and the goshawk. These are bold marauders and do most of the mischief that is attributed to the hawk group. Their trade is battle, murder, and sudden death, and they fully deserve the death sentence that has been passed on them. About 450 distinct species of hawk are recognized, but only 34 are found in the United States and Canada. All are day-seeking birds of prey and possess remarkable keenness of vision, great swiftness of flight, and immense clutching power. They are distinguished from the vultures by the fact that they rarely taste anything they have not themselves killed. Most of them are plainly dressed in browns and grayish whites with darker markings, and are unadorned with plumes. They lack a singing voice, their call resembling a harsh scream more than a song. According to species, they nest on the ground or in trees.

FATHER HAWK ON GUARD

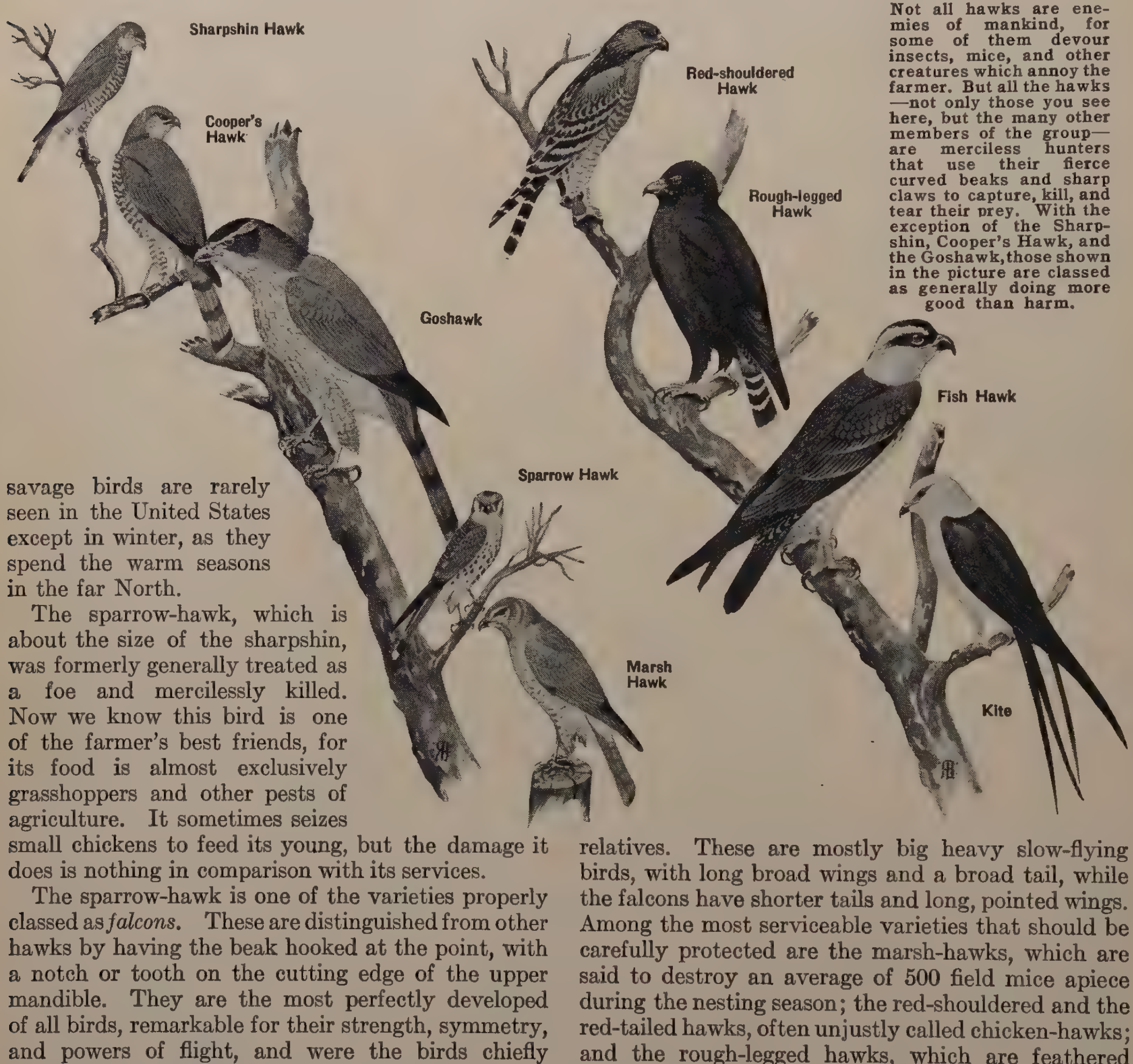
It seems that the Marsh Hawks feel perfectly able to defend their homes, for they build nests on the ground without much attempt at concealment. The male hawk helps in the building and in feeding the babies. Here the male is shown guarding the eggs. Even young hawks in the nest will fight if you attempt to touch them.

The sharpshin is the smallest of the three pernicious hawks. It is a bird about 11 inches long, bluish gray above, and white, heavily barred with brown, beneath. Although no larger than a robin this murderous little villain will destroy all the small birds in its neighborhood, from the flickers and doves to the tiny warblers. It is partial to chickens, and often exterminates whole broods.

Cooper's hawk, which is about one-third larger than the sharpshin, is even more fierce and destructive. It will snatch a young chicken from before the eyes of the farmer and be off before he can recover from the surprise. It not only carries off good-sized fowls but even grouse and rabbits.

The goshawk is twice the size of the sharpshin and is the boldest and most destructive of all. This bird has been known to snatch a wounded game-bird from beneath the feet of the hunter. The young goshawk, which is even bolder than its elders, is sometimes confused with the harmless red-tailed hawk, because of its brownish plumage. Fortunately these savage birds are rarely seen in the United States except in winter, as they spend the warm seasons in the far North.

A GROUP OF FIERCE AIR PIRATES



Not all hawks are enemies of mankind, for some of them devour insects, mice, and other creatures which annoy the farmer. But all the hawks—not only those you see here, but the many other members of the group—are merciless hunters that use their fierce curved beaks and sharp claws to capture, kill, and tear their prey. With the exception of the Sharpshin, Cooper's Hawk, and the Goshawk, those shown in the picture are classed as generally doing more good than harm.

The sparrow-hawk, which is about the size of the sharpshin, was formerly generally treated as a foe and mercilessly killed. Now we know this bird is one of the farmer's best friends, for its food is almost exclusively grasshoppers and other pests of agriculture. It sometimes seizes small chickens to feed its young, but the damage it does is nothing in comparison with its services.

The sparrow-hawk is one of the varieties properly classed as *falcons*. These are distinguished from other hawks by having the beak hooked at the point, with a notch or tooth on the cutting edge of the upper mandible. They are the most perfectly developed of all birds, remarkable for their strength, symmetry, and powers of flight, and were the birds chiefly employed in the sport of falconry, which was one of the most popular amusements of the Middle Ages. With "hooded" falcons on their gloved wrists, the hunters would sally forth in search of game birds. When the "quarry" was sighted, the falcon's hood was slipped and it was thrown into the air, to dart like an arrow at the prey, plunging its talons into it and crouching over it until the hunter galloped up. The most prized falcon was the peregrine or duck-hawk, which is today so rare and shy that its depredations are inconsiderable. This falcon was reserved exclusively for the use of earls, while only royalty could hunt with the great gerfalcon. (For illustration in colors of sparrow-hawk, *see* Birds.)

Nearly all of the buzzard-hawks are valuable allies to the farmer and sportsman, although they have been made to suffer for the sins of their buccaneering relatives. These are mostly big heavy slow-flying birds, with long broad wings and a broad tail, while the falcons have shorter tails and long, pointed wings. Among the most serviceable varieties that should be carefully protected are the marsh-hawks, which are said to destroy an average of 500 field mice apiece during the nesting season; the red-shouldered and the red-tailed hawks, often unjustly called chicken-hawks; and the rough-legged hawks, which are feathered down to the toes and come to the United States in winter to range the fields in search of mice. Some of these friends of the farmer may occasionally seize a chicken to feed their young, but the damage is made up many times over by their services.

The fish-hawks, or ospreys, are close relatives of the hawks and falcons, but they live exclusively on fish. They are found on all the continents near the ocean or other large bodies of water. They cannot dive, as the ducks do, but catch fish by pouncing on them from a great height and seizing them in their talons. The sea-eagles, especially our own bald eagles, often rob them of their prey by swooping down on them and forcing them to drop the fish or be caught themselves.

Kites are medium-sized birds closely related to the buzzard-hawks, though with weaker grasping power in their slender feet, with forked tails, and long pointed wings. The swallow-tailed kites of the southern United States are the most graceful and beautiful in flight of all North American birds. They seem to live almost entirely in the air, floating and soaring with superlative ease on their powerful wings, and even eating and drinking while in flight.

Eagles, hawks, and kites belong to the suborder *Falcones* of the order *Raptores*. Scientific name of sharpshin, *Accipiter velox;* marsh-hawk, *Circus hudsonius;* sparrow-hawk, *Falco sparverius;* fish-hawk, *Pandion halaetus;* swallow-tailed kite, *Elaneïdes fortificatus.*

SOME DAY THEY'LL WEAR RED

When these three little "Red-shouldered" Hawks grow up, they will have their suits made with little patches of reddish feathers at the top of their wings.

HAWTHORN. In his pictures of happy scenes Milton remembers the hawthorn—

> And every shepherd tells his tale
> Under the hawthorn in the dale.

Many other English poets have commemorated the charm of this lovely shrubby tree, which has long been a favorite in England for gardens and hedges.

The hawthorn grows wild throughout Europe, in northern Africa and western Asia, and was introduced into America by the colonists. It rarely reaches a height of 25 feet. It forms a dense growth of handsome foliage, which in most species turns to brilliant colorings in the autumn. In the early spring there is a profusion of fragrant bloom, sometimes tinged with pink but usually white, "white as the hawthorn buds that ope in the month of May." The English often call the hawthorn "may," and use the flowering branches for May Day decorations. The fruit, known as "haws," and usually red, with hard seeds, looks like miniature apples. In pastures the hawthorn seldom grows larger than a bush, as the grazing cattle are very fond of the leaves and fresh shoots, despite the numerous thorns. The wood is very hard and is valuable for making mallet and hammer handles and other implements. The bark was formerly used in Scotland in the making of black dye. Apple cuttings are often grafted on hawthorn stocks.

Numerous varieties have been developed by cultivation, differing in leaf, flower, and fruit. In England the flowers are extraordinarily sweet, but the American species are not so fragrant. Scientific name of the English hawthorn, *Crataegus oxyacantha.*

HAWTHORNE, NATHANIEL (1804–1864). "Hawthorne," says an American critic, "is without doubt the most perfect workman of all American men of letters." No one questions his right to the title of a genius. He was a true artist who took time and pains to make his language the perfect expression of his thought. Finely sensitive to beauty, he made his style delicate, simple, and pure. He had also a gift of penetrating insight into human hearts.

A native of Salem, Mass., he was a true New Englander, his ancestors having come to the New World in 1630. Born and bred in Puritanism, steeped in its legends and tradition, Hawthorne with his sensitive mind interpreted it as no one else could. His greatest book, 'The Scarlet Letter', is the story of sin and punishment and repentance in old Salem; and 'The House of the Seven Gables' is a study of the influences that shaped its characters.

Hawthorne's early life was of a sort to make him quiet and reflective. He was a lonely boy, for his father, a sea captain, died when he was four, and his mother shut herself away from the world with her boy on the shores of Sebago Lake in Maine. There he amused himself in walking, hunting, skating, having his books and his thoughts as his only company. His surroundings were much like the early environment of Cooper, but where Cooper saw the outward things of nature, Hawthorne turned his thoughts to the unseen and spiritual. Such a life gave him a shyness and reserve that he never overcame. Even when he went to college, at Bowdoin, where he was a classmate of Longfellow and the companion of Franklin Pierce, who later became President, he did not make many friends.

After Hawthorne left college he returned to Salem, where he lived almost like a hermit until he was 33. But he was very busy all this time, thinking and writing, though he published little. This long quiet time of preparation doubtless accounts for his depth of thought and perfection of style; for there is never anything crude or immature about his writing.

For a time Hawthorne lived at Brook Farm, where a group of literary men and women were trying an experiment in community life, and from this he got the idea for his 'Blithedale Romance'. He married Miss Sophia Peabody in 1842 and for a time they lived in Concord, Mass., in the "Old Manse," in intimate friendship with Thoreau, Emerson, and Margaret Fuller. Then, because he could not earn enough by writing to support his family, he took a position in the Salem custom house. Under the

HAWTHORNE READING TO HIS CHILDREN

Here is Nathaniel Hawthorne in his library reading from his 'Tanglewood Tales' to his little daughter Una, aged 9, and her brother Julian, two years younger. See how interested they look! Like so many other children, they loved these fascinating stories o the Greek gods and heroes, and could repeat most of them by heart before the book was printed.

influence of the old atmosphere that had so strongly touched his imagination, his thoughts began to take definite shape in the story that made him famous, 'The Scarlet Letter' (1850). After it was published, as he said, "fame was won," and his future was secure.

When Franklin Pierce became president he sent his old classmate as consul to England, so Hawthorne had a chance for European travel, visiting also France and Italy. Broken by ill health and saddened by the Civil War, he did not live many years after his return in 1860. The 'Dolliver Romance' he had never finished, and the manuscript was buried with him.

None of Hawthorne's novels could be called bright and cheerful, though they have touches of quiet humor. They are overhung with a sense of mystery and unseen influences. One of his favorite themes is sin and its growth, repentance and atonement—truly Puritan subjects. Many of his tales are symbols or allegories —such as 'The Great Stone Face'. On his stories for children he put the same care and thought as on his novels for older folk.

Hawthorne's principal works were: *Novels*—'The Scarlet Letter' (1850); 'The House of the Seven Gables' (1851); 'The Blithedale Romance' (1852); 'The Marble Faun' (1860). *Sketches and Tales*—'Twice-Told Tales' (1837); 'Mosses from an Old Manse' (1846); 'Our Old Home' (1863). *Books and Stories for Children*—'Grandfather's Chair' (1841); 'A Wonder Book for Boys and Girls' (1851); 'The Snow Image and Other Tales' (1851); 'Tanglewood Tales (1852).

HAY. "Hay, good hay, hath no fellow," says Bottom in 'Midsummer Night's Dream' while crowned with his ass' head; and he is certainly right from the standpoint of feeding farm animals, especially for use during the months when the pastures are brown and dead. In the United States the annual hay-crop is exceeded in value only by corn, wheat, and cotton. To produce the grand total of 100,000,000 tons, which is the approximate amount used annually in the United States, legumes such as clover, alfalfa, and cowpeas, grasses such as timothy, meadow grass, and brome grass, and even the cereal grains, rye, oats, and barley, are cut as fodder. The pasture-lands are covered almost entirely by native grasses, but the great bulk of the hay crop is furnished by these plants brought from foreign fields.

In order to keep a large portion of the sugars and other soluble matter stored in stalk and leaves by the growing plant, most hays are cut while the grass is still in flower and before the seed matures. If left standing too long, the stems and leaves rapidly lose their nourishment, becoming dry and useless for feed. Sometimes two or more crops may be obtained from the hayfield in a year. It is usually cut and left on the field about three days to dry or "cure" in the sun. When properly done, curing develops a desirable flavor and the characteristic aroma which makes the meadows "sweet with hay." To prevent it from drying too rapidly and to protect it from rain, it is raked into windrows or put up in cocks. About a week after cutting it is loaded in hay racks and hauled to the barn or stack. Hay tedders, hay rakes, and hay loaders greatly lessen the work and hay presses have come into quite general use to bale the hay because the bulkiness of the loose hay is a great disadvantage in storage or transportation.

The chief hay-producing states are New York, California, Wisconsin, Ohio, Iowa and Nebraska.

HAY'DN, FRANZ JOSEPH (1732–1809). The nickname "Papa Haydn," by which this great musician was familiarly known expresses the great affection in which he was held by all who knew him. He was a real father to his associates, as he was to all young and struggling men of talent.

Haydn's father, a mechanic of the town of Rohrau, in lower Austria, was a man of refined tastes. He was fond of music, and the evenings of Haydn's early childhood were spent listening to his father play the harp while his mother sang the folksongs of Hungary, the themes of which later found their way into some of the finest compositions of the master. The child showed marked ability along musical lines, and at the age of eight was made a chorister in the chapel of St. Stephen, in Vienna. Here for nine years he sang and studied, but at the age of 17 his voice broke. Because of some boyish prank, he was expelled from the school and found himself penniless in the streets. Ten long hard years followed. Hungry, cold, ragged, but always devoted to the art of music, Haydn struggled against poverty, and at last fortune smiled. He was made director of the orchestra of Prince Esterhazy, at that time the finest in Austria, and for 30 years he held this position. During this time his compositions were most numerous, and his fame as a composer spread to Leipzig, Paris, and even London.

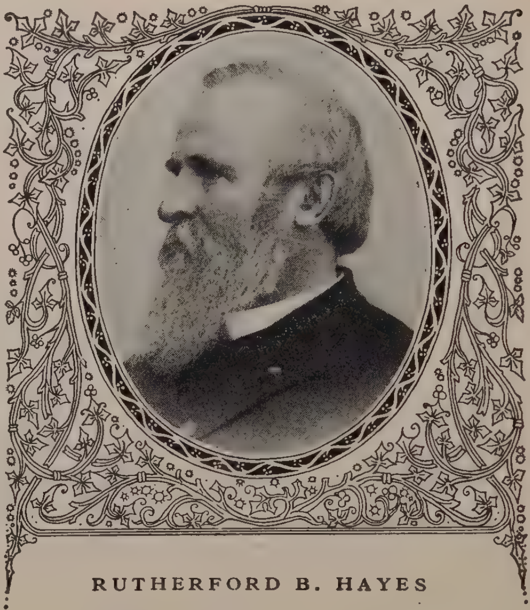
The friendship which sprang up at this period between Haydn and the great Mozart was one of great moment for both the composers. Mozart was so frank in his recognition of the elder man's work that he said he never heard one of Haydn's compositions without learning something from it, and called him "the greatest composer in the world." Haydn profited no less from the association, for it was from Mozart that he derived much of the mastery of orchestral effect that marks his later symphonies.

When 58 years of age Haydn visited England. He was received with the greatest enthusiasm, and Oxford University conferred on him the degree of Doctor of Music. During his stay of 18 months he produced his opera 'Orfeo', nine symphonies, and numerous other compositions, among them the accompaniments of more than 100 Scotch songs.

In his 66th year Haydn's great oratorio 'The Creation' was produced. Among the compositions of his declining years was the Austrian national anthem. He died in Vienna, during the French occupation of that city, and many French officers were among the mourners at his funeral.

Haydn's compositions are numerous, including 125 symphonies, 76 quartets (which are the most distinctive of his works), three oratorios, 54 sonatas, 16 masses, and many smaller pieces for the church.

PRESIDENT HAYES, *Valiant Fighter in War and Peace*



RUTHERFORD B. HAYES

HAYES, Rutherford Birchard (1822–1893). "The name of Hayes began by valor," wrote a member of the Hayes family in the 17th century, and the family tradition was worthily carried on by Rutherford B. Hayes, the 19th president of the United States. On the battle-fields of the Civil War, and equally in the White House at Washington, he displayed conspicuous bravery in overcoming difficulties and in fighting against great odds.

Hayes' administration is especially noteworthy for being ushered in by a dispute concerning the presidential election which was so bitterly contested that civil war loomed as a possibility. This was the only time in the history of the country that such a danger threatened, except when war actually came with Lincoln's administration. Hayes' term of office was also marked by the ending of the Reconstruction Period in the South through the withdrawal of federal troops, by the resumption of specie payments, and by the passage of the Bland-Allison silver act.

Rutherford B. Hayes was born in Delaware, Ohio, Oct. 4, 1822, and received a good education, which enabled him to fill well all the positions in which he was placed. In 1842 he was graduated from Kenyon College (Gambier, Ohio) as valedictorian of his class; and after three years more of study, in the law school of Harvard University, he was admitted to the bar of the State of Ohio. To the end of his life Hayes maintained his interest in education. When he was in Congress he worked to improve the Library of Congress; and after he retired from the presidency he served on the board of trustees of Ohio Wesleyan University, and of the Ohio State University. He was also a member of the board of trustees of the John F. Slater Fund for the promotion of industrial education among the negroes, and of the Peabody Education Fund for the promotion of education in the South.

His Service in the Civil War

Hayes' early interest in the negro was displayed when he cast his first vote for Henry Clay, in 1844, as an anti-slavery Whig. To this party he adhered until the formation of the Republican party, in 1856. When the Civil War broke out, following the Republican triumph in the election of Lincoln in 1860, Hayes immediately volunteered for military service, and was elected captain of a regiment which was raised by the literary club to which he belonged. He declined at this time a commission as colonel which President Lincoln sent him, but later accepted a major's commission. His courage on the battle-field was conspicuous, as was proved by several wounds received in notable engagements and his conduct in the battle of Winchester (Sept. 19, 1864), where he led his brigade through a deep slough in the face of the enemy. This gallant action won for him the admiration of his men, and the rank of brigadier-general. He was promoted later to the rank of major-general.

While he was still in the field (August 1864) he was nominated for Congress from his home district in Ohio. A friend urged him to apply for leave of absence that he might campaign for the position, but Hayes refused, saying: "An officer fit for duty who, at this crisis, would abandon his post to electioneer for a seat in Congress ought to be scalped." Without any effort on his part he was elected and served with ability. In 1866 he was re-elected, and before his second term had expired, he resigned to become governor of Ohio. Three times he was called upon to act as governor of that state. The last time that he was elected (in 1875) he stood on a platform calling for "sound money," in opposition to the Democratic policy of indefinitely postponing the resumption of specie payments and the policy of paper money.

The Famous Hayes-Tilden Election Dispute

It was Governor Hayes' position on this question that won for him the Republican nomination for the presidency in 1876 over James G. Blaine, with William A. Wheeler of New York as vice-presidential candidate. The Democratic candidate for president was Samuel J. Tilden of New York, who was also supported by many reform Republicans. Three states — Louisiana, Florida, and South Carolina — each sent in two sets of returns, one for Hayes by the "carpet bag" government, the other for Tilden, by governments set up by ex-Confederates. Both parties charged frauds on the part of their opponents. The Senate was Republican and the House Democratic, so the decision as to the disputed votes was left to an Electoral Commission, composed of five senators, five representatives, and five justices of the Supreme Court. The decision—by a party vote of eight to seven, on every question—favored the Republicans; and Hayes was declared elected, by 185 electoral votes to 184 for Tilden. So bitter was party feeling that at one time it was feared that the government might be seized by force and the country plunged into a struggle of the kind so frequent in Latin-American countries.

ADMINISTRATION OF
RUTHERFORD B. HAYES
1877–1881

Civil Service Reform begun.

Federal troops removed from the South and Reconstruction ended (1877).

Halifax Award in fisheries dispute with Great Britain (1877).

First electric lighting of streets (1877).

Use of telephones begun (1877).

Miners' strikes ("Molly McGuire" outrages) and railroad strikes (1876–77).

Right of States to regulate railroad rates upheld (1877).

Greenback Party at height of its power (1878).

Bland-Allison Silver Act passed over the President's veto (1878).

Resumption of specie payments (1879).

Exodus of southern freedmen to northern states (1879–80).

Not renominated because he had opposed Congressional leaders.

A few days after he was inaugurated, Hayes braved the angry protests of leading politicians of his party by removing the United States troops from the South, thus ending the period of Reconstruction. This sealed the fate of the "carpetbag" Republican governments which had made his election possible, and which could not exist without the protection of Federal soldiers.

President Hayes further angered the politicians who had put him in office by asking for an appropriation for a civil service commission. This was refused by Congress, but he nevertheless administered a heavy blow to the "spoils system" by granting many clerkships in executive offices on the basis of a competitive examination, and without regard to the politics of the applicant.

Though the politicians did not like these measures, the people did. The President's popularity was increased in many quarters by the unflinching determination with which he caused the resumption of specie payments. Many people in the agricultural Middle West were opposed to this measure and formed a third party, called the Greenback party. Its influence was increased by the support of a considerable labor group as a result of the severe business depression in 1876–77. Unemployment and reduced wages led first to violent strikes, later to political activity. In 1878 these two groups united in the Greenback-Labor party and elected 14 congressmen. Despite this protest and the strenuous objection of some of his party leaders, Hayes continued to accumulate a gold reserve, and on Jan. 1, 1879, for the first time since the Civil War, the government announced that it would pay out gold ("specie") in return for its paper money. The opponents of the government's financial policy succeeded, however, in passing the Bland-Allison Act over the president's veto. This provided that the government should coin each month from $2,000,000 to $4,000,000 in silver dollars to be full legal tender. Hayes vetoed this measure because the price of silver was falling and each dollar would contain only about 90 cents' worth of silver.

In foreign affairs the Atlantic fisheries dispute with Great Britain was temporarily settled by the Halifax Award. In 1879 Hayes vetoed a Chinese exclusion bill, because it violated a treaty with China; but later he secured a new treaty which permitted Congress to regulate the immigration of Chinese laborers.

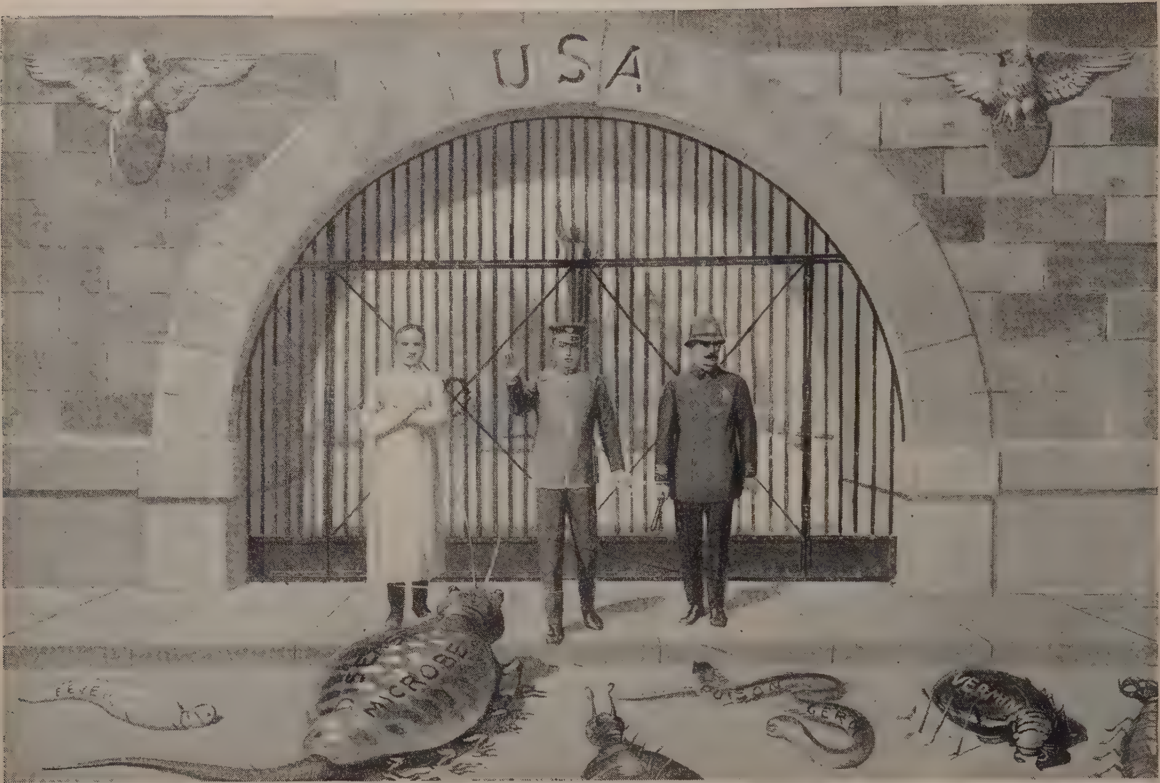
Hayes' constant antagonism to the politicians in Congress naturally made it hopeless for him to look for a renomination. He retired to private life with the end of his term (March 4, 1881) and devoted his time thenceforth to educational and social betterment. As president of the National Prison Reform Association he worked for a more scientific treatment of criminals, a labor which was probably as great a benefit to his country as was his presidential administration. He died at his home in Fremont, Ohio, on Jan. 17, 1893.

HAZEL.—Although the hazel furnishes effective little rods for hoops and baskets and crates, it is known chiefly for its nuts. Some cultivated varieties grown in Europe, such as the filbert, are collected for the market, but the two woodland species that grow in North America are mere shrubs or bushes and the nuts have little market value. These nuts lie in leafy cups in clusters of two, three, or four, and from their light brown shade we get the color term "hazel." The oil pressed from hazelnuts is used by perfumers and painters and in medicine.

In certain European lands the forked hazel twig was once believed to be a magic divining rod that could point to the place where precious minerals or other objects lay hidden, or where water might be found by well diggers. In North America this power was ascribed to an entirely different shrub—the witch-hazel.

The hazels belong to the birch family (*Betulaceae*). Scientific name of common hazel, *Corylus avellana;* of American hazel, *Corylus americana.*

Workers who FIGHT OUR BATTLES *against Disease*



A NATION'S greatest asset is the health of its people, as the United States was made to realize in the World War when one-third of its young men between 21 and 31 were rejected for active service with the army on account of physical defects. No department of the federal government has more important duties to perform than the Public Health Service (a branch of the Treasury Department), with its trained workers all over the country who are constantly warring on dirt, contagion, and disease.

HEALTH DEPARTMENT. The work of protecting the nation's health begins at its borders. All the entrance ways into the country are guarded. Every ship that enters an American harbor is met by a revenue cutter flying the yellow flag of the United States Public Health Service, and if there is one case of yellow fever, smallpox, bubonic plague, or other contagious disease, it is forced to remain in "quarantine" for a specified time, during which passengers and crew are not allowed to land and cargo may not be discharged. Sometimes ships from foreign cities where these diseases are known to exist are not allowed to enter American ports at all. Immigrants are not allowed to come into the country if they have tuberculosis, or contagious diseases of the eye or skin.

The government health officers have thrown out their pickets far and wide. In Shanghai, Naples, and some 30 other places, trained "health scouts" are stationed to watch for contagious diseases and report to the home office. The American consuls stationed all over the world also report on health conditions to the Public Health Bureau in Washington. If plague breaks out in China today the Washington authorities know it at once, and notify the health police at all ports of entry.

When such diseases as yellow fever, typhoid fever, malaria, Rocky Mountain spotted fever, hookworm, and pellagra occur within the nation's borders, the causes are investigated and the best method of fighting them ascertained. One of the striking examples of government disease extermination was the triumph over the yellow fever and malarial mosquito in Panama. The story of this wonderful achievement which turned one of the plague spots of the world into a healthy locality is told in the article on the Panama Canal.

Local work is carried on by state and city health departments, which coöperate with the Washington authorities. Doctors are compelled to report all contagious diseases to the local health department, and those families in which there is smallpox, scarlet fever, or diphtheria are "quarantined," that is, a card is put on the house warning others to remain outside, while members of the family are not allowed to leave the premises. Children with measles, mumps, whooping cough, and chicken-pox are kept from school so the other children will not be exposed, and public schools

GUARDIANS OF OUR HEALTH AT WORK

Here we see some of the chief ways in which public health is safeguarded. Examination of immigrants for infectious diseases; vaccination; disinfection of clothing which has been exposed to contagion; food inspection; examining school children for tuberculosis; diagnosing germ diseases with the microscope.

may be closed entirely in case of epidemics. After the patient is reported well, city health officers come and disinfect the house with formaldehyde or other disinfectants. Clothes that can be washed must be boiled. Rugs, mattresses and bedding, in some cities, are removed to the city's plant to be disinfected and returned.

Protecting Workers against Disease and Accident

Factories are inspected to see that workers are not overcrowded, that guards are put on machines to prevent accidents, that good light and air are supplied, and that children under a certain age are not at work for wages. Pure food laws are passed to prevent the sale of unfit food.

In cities, where so many people are living in such a small area, a great deal more is usually done to protect the health of the people than in the country where there is plenty of pure air and sunshine. The health department of a large city frequently employs several hundred people. The fight against dirt is constant, for dirt is the great disease breeder. Thanks to the vigilance of our health departments, the open garbage pail has disappeared, with the filthy piles of refuse and cesspools that once made many alleys and backyards breeders of disease. Many cities still cling to the abominable old-fashioned method of street-cleaning by sweeping the refuse and dust into piles and loading it into open carts, while the germs of a hundred diseases are scattered broadcast by every puff of wind. But modern ingenuity will speedily end this nuisance, too, for sanitary inclosed street-sweeping machines are now coming into use.

One of the first duties of a city health department is to insure a constant supply of pure water (*see* Waterworks). It is necessary also that milk, which forms the chief food of children and sick people, be safe, and strict laws regulate its production and distribution. Pure air is another thing we need if we are to be healthy, and the heavy pall of smoke that hovers over our cities is a problem on which all health experts are working (*see* Smoke).

Inspecting Food Supplies

Restaurants and bakeries are inspected periodically to see that the food is prepared in a sanitary manner. If there is a dirty factory or stable near you that breeds flies, the health officers will see that the place is cleaned, for flies carry disease. Bakeries, markets, cold storage houses, and fruit markets are watched to see that no spoiled food is sold. Plumbing and gas pipes are subject to city inspection, and if the owner does not make the necessary repairs his place may be closed to tenants. The health department is usually responsible also for keeping vital statistics, that is, records of births, deaths and their causes, the number of cases of contagious diseases, accidents and their causes, etc.

One of the best weapons of the health officer is publicity. By giving publicity to unhealthful conditions, the city pride is aroused and inefficient officers and shameless milk-dealers and food-law violators are shamed into enforcing and obeying the law. Much good, too, has been done by campaigns of education as to care of children, or against common drinking cups and roller towels, and other spreaders of disease.

Many city school boards employ school doctors and visiting nurses who examine the children's eyes, ears, noses, throats, teeth, and skin, watch for contagious diseases, and save many children who are in the early stages of tuberculosis. If the parents are unable to pay for glasses, for dental work, or for removing bad tonsils or adenoids, or for any other trouble, the children can be treated in free dispensaries and hospitals. Every city has public hospitals supported by taxes to take care of its sick, and many are beginning to build camp hospitals and sanitariums for people with tuberculosis (*see* Hospitals). To all these public agencies the Red Cross and many private organizations have added their efforts and resources.

Really effective work has only been possible since the bacterial nature of disease has been known (*see* Germ Theory of Disease). While a health officer's work formerly consisted in enforcing strict quarantine and in cleaning up nuisances which were offensive to the smell, today through the vast amount of knowledge possessed concerning infectious diseases, preventive medicine is an exact science. Every United States soldier in the World War was inoculated with serums which made him immune to some of the most deadly scourges of previous wars. The detection of many diseases is made in laboratories of state and national health bureaus, and better methods of treatment are constantly being discovered.

Terrible Conditions in "the Good Old Times"

In "the good old times" that some look back to with regret, there was virtually no care of the public health and frequent epidemics devastated whole cities and districts. One baby in three died. Middle age was toothless, on the average life was 20 years shorter than now, and unspeakable filth was tolerated. It would be impossible today to find such a combination of luxury and filthy, disease-breeding conditions as that in the midst of which Queen Bess and her courtiers held sway. Smallpox, until the discovery of vaccination in 1796 by Jenner, was as common as measles today. A 17th century writer remarks that in any gathering, the face of one out of every four would be horribly disfigured by the disease. At one time the "plague," a terrible disease which has its real home in China, was common in Europe, as also was leprosy, although these two hideous diseases are rare today in civilized countries (*see* Black Death). Yellow fever and malaria have been wiped out in places where they have raged for ages, by the extermination of the mosquitoes that carried them. Not very long ago a terrible disease broke out in Malta, and was known as Malta fever, but it was stopped when it was discovered that it is carried in infected goat's milk. The dread typhoid fever, the most dangerous of all filth diseases was looked upon, only a few years back, as a disease that could not be prevented or controlled; but it can be almost completely wiped out by intelligent care. Indeed, it is a common saying that the intelligence of a community in sanitary affairs is indicated by the number of typhoid deaths. Cholera once swept frequently from country to country, and it was the great epidemic of 1848–49 that awakened the United States to the whole question of sanitation and fighting diseases coöperatively. Only a generation ago typhus was very common; now it hardly causes ten deaths in the whole of America in one year. But the disease is still common in backward countries of Europe and Asia; and in the World War it broke out in the trenches of the invaded countries.

The Fight against the White Plague

Tuberculosis is the most dreadful scourge that still afflicts the civilized world. The microbe that causes it was discovered near the end of the last century, and it has been learned that we catch it from one another and from other conveyors such as milk. The number of people who have tuberculosis is not so great in civilized countries as it used to be, and the number will be constantly less if we act on the knowledge we have. The health department watches that we receive no milk from tuberculous cows; we can be careful never to spit on the streets or in public places; most people keep their windows open at night; and it is not too much to hope that when the children who read this are grown, a case of tuberculosis will be as rare as a case of smallpox is today.

The next generation will realize, much more than this one, the importance of health and the right everyone has to it, and will understand the reason why health measures are advocated and why people should observe them. Everybody should be a soldier in the army that fights for good health and should see that statesmen and governments put it first in their programs for human betterment.

No better evidence of this worldwide importance of health could be given than the place it occupies in the business of the League of Nations under Article XXIII, for the health commission was one of the first to be instituted and put to work.

The LIVING PUMP *That Keeps* OUR BLOOD *Pulsing*

Some Glimpses at the Most Remarkable of all Engines, the Heart—An Engine which Never Sleeps, but Keeps Beating 100,000 Times Every Day of Our Lives—How It is Built, How It Works, and Some of Its Troubles

HEART. We have all heard the expression "getting to the heart of the matter," and "winning another's heart," and "losing heart" when we are discouraged. These common sayings would tell us, even if we did not know in other ways, that the heart holds a vital place in our lives. It is the pump upon which we depend to force the blood to the farthest extremities of the body, and when anything goes wrong with this pump, our very lives are endangered.

By the beating of the heart we can judge pretty accurately the well-being of the other organs of the body. For if any one of them is in trouble, the beating of the heart is usually affected. It either beats faster or slower, depending upon what is the matter. When all is well, the tiny baby's heart beats about 120 times a minute, while the grown person's heart beats only about 72 times. Small animals, like the rabbit, have rapid hearts; the baby in this matter behaves like a small animal.

Why Our Pulses Time the Heart Beats

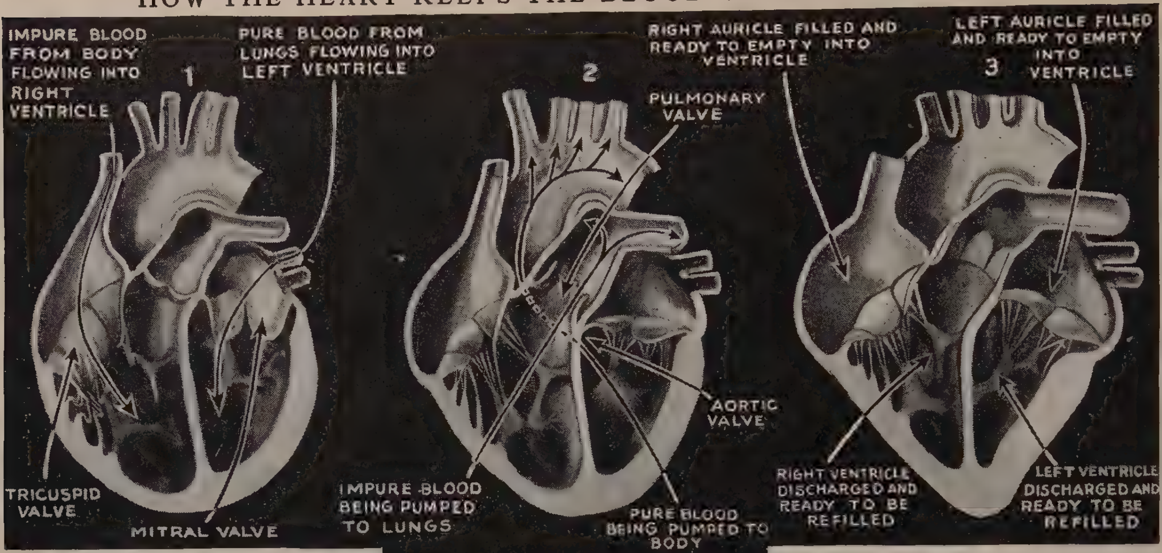
The arteries which carry the blood from the heart are like pipe-lines that have elastic walls. As a result we can plainly feel the beating of the heart at certain points on the outside of the body. The blood is forced into these arteries in a spurt, followed by a slight pause and then another spurt. The elastic walls of the arteries, in order to take care of each spurt as it comes, must stretch and then contract. So instead of a smooth flow of the blood, we have a wave-like motion, which we can feel. We call this the "pulse," and it can be most plainly felt on the wrist or at the side of the throat.

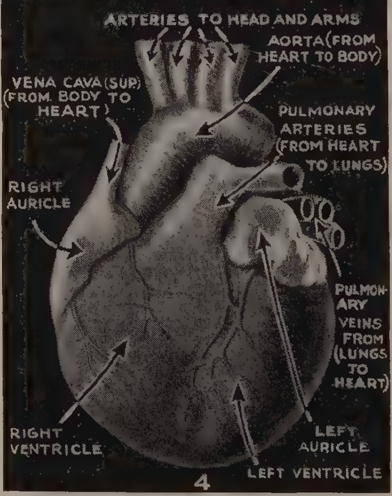
With the exception of certain simple forms, animals have an organ which does this same kind of work—from such low species as the earthworms, which have just a tube with muscular walls that can contract in a regular rythmic way; to the fishes with their two-chambered heart; snakes, frogs, and toads, whose hearts have three chambers; and the birds, brutes, and man, whose hearts have four chambers. From the way in which the heart is made we can trace something of the ancestry of an animal.

In the human body, the heart is located near the center of the upper or chest cavity. It is a pear-shaped—but slightly flattened—pouch, with very powerful muscular walls. The large end of this pouch points upward, and toward the right shoulder, while the small end points down and to the left. This end lies so close to the surface that we can feel it beat; hence we often speak of the heart as being on the left side, when in reality it is very nearly centered. In the grown man or woman, the heart is about 5 inches long and about 3½ wide. It weighs from 9 to 11 ounces.

We think of our hearts as working day and night, constantly and without rest. But this is not quite true. The real work is done in contracting; the relaxing at the end of each contraction is a passive process. Then there is a slight pause before the next contraction. These pauses and the relaxing preceding

HOW THE HEART KEEPS THE BLOOD STREAM FLOWING


IMPURE BLOOD FROM BODY FLOWING INTO RIGHT VENTRICLE
1
PURE BLOOD FROM LUNGS FLOWING INTO LEFT VENTRICLE
TRICUSPID VALVE
MITRAL VALVE
2
RIGHT AURICLE FILLED AND READY TO EMPTY INTO VENTRICLE
PULMONARY VALVE
AORTIC VALVE
IMPURE BLOOD BEING PUMPED TO LUNGS
PURE BLOOD BEING PUMPED TO BODY
3
LEFT AURICLE FILLED AND READY TO EMPTY INTO VENTRICLE
RIGHT VENTRICLE DISCHARGED AND READY TO BE REFILLED
LEFT VENTRICLE DISCHARGED AND READY TO BE REFILLED


ARTERIES TO HEAD AND ARMS
AORTA (FROM HEART TO BODY)
VENA CAVA (SUP.) (FROM BODY TO HEART)
PULMONARY ARTERIES (FROM HEART TO LUNGS)
RIGHT AURICLE
PULMONARY VEINS FROM (LUNGS TO HEART)
RIGHT VENTRICLE
LEFT AURICLE
LEFT VENTRICLE
4

In the lower picture (4) you see how the divisions of the heart are named and how they connect to various parts of the body. Impure blood from the body comes to the right auricle. From there it passes to the right ventricle, which pumps it to the lungs. Returning purified from the lungs, it enters the left auricle, passes to the left ventricle, which pumps it out again to the body. The pumping process, shown in the three upper pictures, consists of a contraction which works from top to bottom of the heart on both sides at the same time. In (1) both auricles are filled, the right with impure blood from the body and the left with pure blood from the lungs, and the beginning of the contraction is forcing the blood through the valves into the ventricles. In (2) the contraction has passed to the ventricles. The "back pressure" has closed the valves to the auricles, and is forcing the blood from the right ventricle to the lungs and from the left ventricle to the body. In (3) the contraction is finished. The ventricles have been discharged, the auricles have been filled, and an instant later the process will be repeated.

them total about 15 hours in every 24; so we can say that the heart works only nine hours a day. During these rest periods the heart feeds itself. Though it moves only about six ounces of blood at each stroke, it beats about 100,000 times in a day, so that the work done by it is equivalent to moving 12 tons in each 24 hours. The heart must be kept rested and fed, else its work is hindered.

The walls of the heart are made up of three coats—an outside coat; a middle one, which is a very powerful muscular layer; and an inner coat, very thin and delicate, which lines the heart and also forms part of the doors or valves. A partition runs down through the middle of the heart which divides it into two absolutely separate portions (the right and left sides). This really makes two distinct pumps, which work at the same time but handle somewhat different kinds of blood. Each side is again divided by a cross partition into an upper and a lower chamber. The upper chamber is called the "auricle" (right or left, as the case may be). The lower chamber is called the "ventricle" (right or left). In the partitions between the upper and lower chambers there are doors called valves. The door on the right side has three sections ("tricuspid valve"), and it is so hinged that the blood flowing into the lower chamber or ventricle will close the door when the chamber is full and prevent a backward flow. For the door will open only in one direction. On the left side the door between the auricle and the ventricle has only two sections ("mitral valve"). It is hinged and acts very like the door on the right side.

Opening out into an artery from each of the ventricles is another door made in three sections, and called the "semilunar valve" because it somewhat resembles a half-moon. These doors open and close automatically as the blood passes through. A physician with a stethoscope can tell by the sound of the valves whether they are working properly.

When we look closely at this double pump, we find entering the upper and right auricle large veins which have gathered up the blood from all over the system and brought it back to the heart. This blood is sadly lacking in oxygen and has much carbon dioxide, a waste material. Entering the right auricle, this dark venous blood passes on through the valve into the right ventricle and is then pushed by the contraction of the ventricle on through the semilunar valves into the pulmonary artery, which carries it to the lungs. Here it gets rid of this carbon dioxide and takes up the life-giving oxygen. It is then gathered up in the pulmonary veins and carried back to the heart. Here it enters the left auricle. This cycle is known as the lung or "pulmonary circulation."

The blood now contains oxygen, and is ready to be sent all over the body. It is bright scarlet in color and is called arterial blood.

How the Pumped Blood is Distributed

On entering the left auricle, it flows (partially forced by the contracting auricle) through the door into the left ventricle, and from there is forced by the contracting ventricle through the semilunar valve into the "aorta," to be distributed all over the body. It passes through smaller and smaller arteries, until it finally gets into the thin-walled capillaries from which it reaches every cell of the system. These capillaries are the tiniest blood-vessels in the body, and it is here that the vital process of "osmosis" takes place, or the actual exchange of the fresh food for the accumulated wastes of the tissue cell. The blood is now ready to go back to the heart. It takes a drop of blood about half a minute to complete the cycle and get back to the heart. The circulation controlled by the pump on the left side is known as the "systemic circulation." And since it must send the blood so much farther, the muscular walls of the left ventricle are much more powerful than those on the right side. (*See* Blood; Physiology; Respiration.)

The heart is automatic; that is, it starts its own beat. But the action of the heart is regulated by two separate nerves. One, the "sympathetic nerve" makes it work faster, the other set of nerve fibers, known as the "vagus" nerve, behave in just the opposite way, tending to slow down the work of the heart. The two keep the action nicely balanced.

The heart may become diseased, mainly from one or two causes—either from overwork or by infection from bacteria carried by the blood. The infection often takes place in bad teeth or tonsils. The infected blood of necessity comes in contact with the delicate inside lining of the heart, and often causes an inflammation which prevents the valves from working properly. This inflammation may spread over the whole inside wall of the heart and bring about more or less serious results. However, the valves naturally suffer the most.

Danger of Overworking that Heart of Yours

We may overwork the heart by too violent exercise or too prolonged. This compels the muscle to work too rapidly, depriving it of its rest period, and hence cuts down the food supply of the heart itself. The heart may be permanently dilated or enlarged. Perhaps the valves get so crowded as to tear them and more or less permanently disable them, when a chronic disease is fastened on them. This is why we should never engage in violent athletic exercise immediately following a meal. The heart is already working hard to supply the digestive organs with extra blood, and if the muscles are put in action at the same time, the heart is overworked.

Anything which tends to disturb the fine balance or regularity of the heart-beat will produce trouble if kept up—possibly palpitation (a too rapid beating) or an inability to contract and expand properly.

The MARVELS *of* HEAT, *and* HOW MEN *Have* MASTERED IT

Once Thought to be a Substance, Now Known to be a Form of Motion—What Science Tells Us of Absolute Zero, and of the Heat of the Sun—How Heat Travels and is Measured, and the Wonderful Heat-Engines that Do Our Work

HEAT. Do you ever wonder what heat really is? Perhaps it would surprise you to learn that for centuries very learned men were puzzled by this question. They weighed a piece of metal and then heated it, only to find that adding heat did not increase the weight. They found, however, that adding heat did increase the *size.* So these wise men of old were led to believe that heat was a mysterious fluid, which was invisible, weighing nothing, but which could flow in some way from the hot body to the cold body. This fluid they called "caloric."

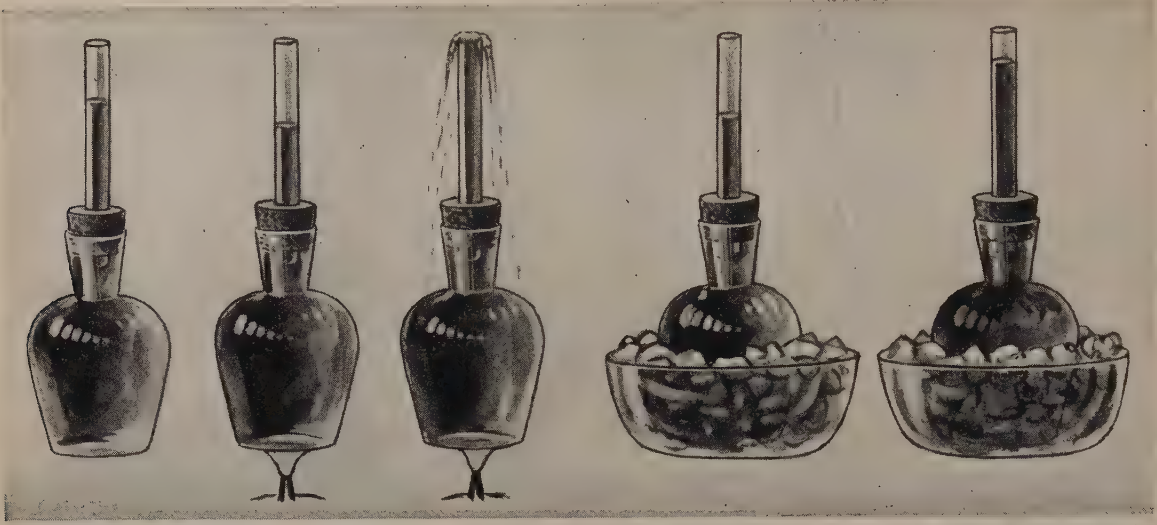
This idea that heat is a material substance was believed until almost the year 1800, and old textbooks in physics speak of "caloric" flowing from one body to another. Thus, caloric was said to flow from the hot coals to the kettle of water. Then in 1798 and 1799 two men, Count Rumford and Sir Humphry Davy, showed by experiments that heat could not be a material substance.

Count Rumford's name, before he was made a noble in Germany, was Benjamin Thompson. He is of special interest to Americans, for he was born in 1753 at Woburn, Mass., the son of an American farmer. He became one of the world's great scientists and engineers, and though he spent most of his life in Europe he did not forget his native land. In his will he left funds to Harvard College for a professorship, and Harvard College still has a "Rumford" professor of physical science, and there is a fund called the "Rumford Fund" to help work in the science of heat.

What a Cannon Taught about Heat

In 1798 Count Rumford wrote to the Royal Society of London an account of experiments that he made while boring brass cannon in Munich for the Bavarian army. He observed (what every machinist knows) that in boring metal the tool and the metal both get hot; but Rumford asked: "Where does this heat come from? What is this heat?" He insulated

STRANGE BEHAVIOR OF WATER WHEN HEATED AND COOLED



Most substances expand steadily when heated. Not so water. The first picture at the left shows a flask and projecting tube containing water just above the freezing point. Note where the water stands in the tube. In the next picture heat has been applied to the flask. The water in it starts to contract, you see. This continues until the temperature rises to about 39 F. (seven degrees above freezing). Then the water begins to expand again until it reaches the boiling point, illustrated by the third flask. The last two flasks show the effect of cold. The bowls are filled with cracked ice and salt, such as is used in making ice-cream. In the first of the two flasks the water is just beginning to freeze. In the second it has turned to ice, and expanded greatly during the process. The force of expansion when water turns to ice is enough to burst great iron pipes.

his brass block by felt, so that the heat could not come from outside; then he used blunt tools and got fewer metal chips, but got more and more heat but by using more and more mechanical work. In his account he wrote: "It is hardly necessary to add that anything which an insulated body can furnish without limitation cannot possibly be a material substance. It must be *motion.*" He meant the motion of the particles of the body.

Then next year Rumford's friend, Sir Humphry Davy, made another experiment to prove that heat was not a substance. He performed his experiment one freezing winter day. He arranged to rub two pieces of ice in a vacuum, and found that he could melt the ice by friction, even when all nearby bodies were below the freezing temperature. He then asked, "Where can this so-called 'caloric' come from?" The only answer was: "There is no substance caloric. Heat is simply motion given to the particles or molecules."

From these experiments of Rumford and Davy the world should have learned the true nature of heat. But it was not until 40 years later that the world realized the full truth of the ideas and experiments of Rumford and Davy. Then, in 1840, James Prescott Joule of Manchester, England, by churning up water and thus heating it, measured in long careful experiments the work needed to produce a unit of heat, that is, he got "the mechanical equivalent of heat." We know from Joule's work, which has been repeated by many others, that it takes 778 foot-pounds of work to produce a "British thermal unit" of heat.

Thus these great men, Rumford, Davy, and Joule, showed us what heat is. If you hammer a piece of iron it gets hot, because the blows of the hammer give motion to the molecules of the iron. You rub two dry sticks together, and under good conditions you produce heat—that is, you set the molecules in high motion, so that the wood catches fire. To explain heat, we must remember that all matter is made up of molecules, and that in all bodies, at temperatures that we know, the molecules are in constant motion. That is, all bodies that we know have heat.

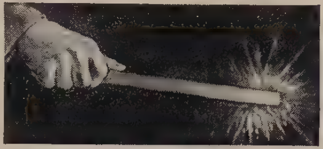
Science has shown that if we could lower the temperature of a body to 459° below zero (Fahrenheit), then the molecules would be at rest—that is, the body would have lost all its heat. Such an intense cold as −459° F. (or −273° Centigrade) has never been reached; but a Dutch scientist, Professor Onnes of Leyden, Holland, has by elaborated machinery got down to about −453° F.; that is, to within five or six degrees of the "absolute zero" of coldness, where a body has absolutely no heat, no motion of its molecules.

Matter has some very interesting properties when its molecules have so very little motion. All gases become liquids or solids, even helium becoming a liquid; and the molecules of a metal near the absolute zero are so close together that a current of electricity finds no resistance. Of course life cannot exist at such low temperatures, for heat is needed to maintain life.

If, on the other hand, we add motion to the molecules of a body, we make it hotter. In the electric arc, we get the most rapid molecular motion that we have produced on the earth, a temperature of about 6,000° F. It is still hotter at the sun, the temperature of that body probably being more than 10,000° F.

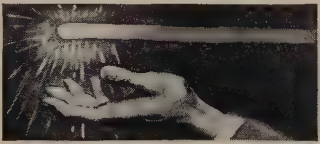
FACTS ABOUT HEAT

Heat is created and transmitted by the impact of molecules.



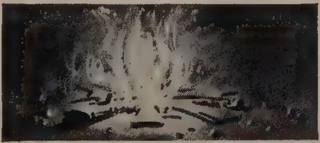
Molecules of the bar carry the heat to the hand by "conduction."

Heated air rises and spreads, carrying heat by "convection."

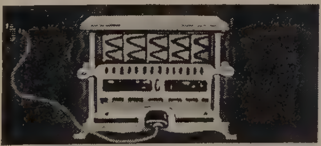


Heat travels in all directions by "radiation" through the ether.

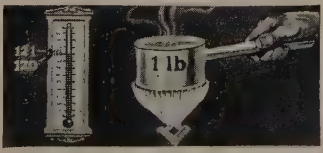
Impact between objects speeds up their molecules and so causes them to become heated.



The rapid motion of molecules undergoing chemical changes is the cause of heat in fire.



A heavy electric current passing through resisting wires creates heat.



The "British Thermal Unit" is the amount of heat needed to raise one pound of water one degree in temperature.

Two very practical questions for man about heat are: "How can we get heat, when we want it?" and "How can we transfer heat from place to place?" Our great source of heat is the sun. The sun continues century after century to send to the earth a constant stream of light and heat, by the method of radiation. Of radiation you will read later in this article. We cannot control the heat that comes from the sun; we can only use what Nature sends us. Different parts of the earth get very different quantities of the sun's heat, and the different seasons are due to the different quantities of heat received from the sun. In winter, in the most civilized countries, the sun's heat is not enough to keep our houses comfortable, so we must use artificial heat. We must also use artificial heat for cooking, and for producing steam for the engines in our factories and power plants and for our locomotives and steamships.

Our great source of artificial heat is found in the burning of wood, coal, oil, and gas. The oxygen of the atmosphere combines with the carbon and gases of the fuel, and in so doing releases energy which sets the molecules in violent motion—that is, produces heat. There are many other chemical actions that produce heat, but the burning of coal, oil, and natural gas is the great artificial source of heat. Think what we should do if we could not get coal or oil to produce heat! Our houses would be cold in winter, and our locomotives and all the other engines of the world could not run.

Another method of producing heat is by passing an electric current through wires (*see* Electricity), and many helpful devices make use of electric heating. Electric heating is, however, very expensive as compared with heat from burning fuels, and can never be a large source of heat. And besides, electric heating itself is in most places dependent upon the burning of coal or oil to run the steam engines that drive the dynamos. Heat from friction and impact also can never be available for large amounts of useful heat.

Heat travels in three ways: by *conduction*, by *convection*, and by *radiation*. When one end of an iron bar is placed in a fire, the rapidly moving molecules of the hot coals and hot gases strike against the iron molecules, and so the iron molecules that touch the fire are given violent motion. These first molecules pass the motion along to other molecules farther back in the iron; and soon the heat travels or is *conducted* to the hand that holds the iron. That is, in conduction the heat motion passes along just as motion passes along a row of balls which bump against each other. The best conductors of heat are the metals. Wood is a poor heat conductor. This is the reason you can hold a burning match even while the wood burns only an eighth of an inch away. A metal wire would have to be several inches long for you to hold it in your hand when one end was red hot. We wrap steam pipes with felt and asbestos because felt and asbestos are poor heat conductors. We wear woolen clothes in winter because woolen cloth does not readily conduct the heat away from the body.

Now take the hot iron bar out of the fire. The air about it is heated, and the hot air rises. In this case, the heat travels upwards by *convection* —that is, by being conveyed by the currents of heated air. In the hot-air furnace for house heating, the heat is transferred to the rooms by convection—by the flow of hot air through the tin ducts. It is by convection, using the flow of steam or hot water through iron pipes, that heat is transferred in steam and hot-water heating systems. In convection, heat is conveyed by moving the hot matter itself as in the case of streams of hot air, hot water, or steam.

But heat can reach your hand from the hot iron bar when your hand is at some distance *beneath* the hot bar. There is no stream of hot air to the hand in this case, because hot air rises. In this case the heat travels neither by passing along from molecule to molecule, as in conduction, nor by the conveying of currents of hot matter, as in convection; but it flies directly across space. This is the way heat and light come to us from the sun across stretches of empty space. This method of transfer is called *radiation*. And what is radiation? Evidently it is not the same as the heat which is the oscillating motions of the molecules of matter, for there is no matter to heat in the long stretches between the earth and the sun. Experiments in the laboratory also show this, for radiation travels across a vacuum just as light does. Indeed, radiation is light. Light is a wave motion in the ether (*see* Ether; Light); but only a small part of these ether waves are visible to our eyes—that is, we have in the sunbeam both visible and invisible light or radiation. When these ether waves strike an object, they are partly absorbed and partly reflected. The energy of the absorbed radiation causes motion of the molecules of the body—that is, causes heat. Some bodies are better absorbers of radiation than others. Thus, a black cloth absorbs more radiation and reflects less radiation than a white cloth; hence dull black bodies get hotter in the sunshine than white bodies. This is one reason why people find white clothes cooler than dark clothes in summer.

How Radiation is Produced

Radiation—that is, ether waves—is produced by the vibrating molecules of hot bodies. As said above, radiations come from hot bodies, and the sun with its high heat gives off an amount of radiation which is enormous compared to any other source that reaches us. Every square foot of the sun gives off as much heat as would be produced by burning 1,500 tons of coal on each square foot every hour. These heat waves, being just like light waves, can be reflected and refracted. Thus, at the focus of a lens or "burning glass" there is gathered both the visible and invisible radiation, so that fire can be started by putting paper or shavings at that point. A concave mirror can be used for this same purpose of concentrating radiation. There is an old story that the Greek philosopher Archimedes of Syracuse set fire to the Roman war ships by the use of a big burning glass or burning mirrors (*see* Archimedes).

HOW ICE MIGHT BE USED TO START A FIRE

If you were caught at the North Pole without matches, or flint, or other means for starting a blaze, what would you do for fire? If you knew enough about the nature of heat and radiation, it might occur to you to shape a rough lens out of clear ice, and with it concentrate the rays of the sun upon inflammable material, as you see this man doing.

There are two measures of heat, the *degree* of heat, and the *quantity* of heat. The *degree* of heat we call the "temperature" of the body. The more rapidly the molecules vibrate, the higher the temperature. Temperature is measured by a thermometer (*see* Thermometers). Our most useful thermometer, the mercury thermometer, shows the temperature by the position of the mercury in the glass stem. This is graduated either in Fahrenheit degrees or in Centigrade degrees, as explained in the article on Thermometers. Two bodies can have the same temperature, and yet have very different *quantities* of heat—first, on account of the *mass* of the body, and second, on account of the *kind* of matter. Thus, a bucket of water will contain much more heat than a cup of the same water. Then again, experiment shows that it takes more than 30 times as much heat to heat a pound of water one degree as it does to heat a pound of mercury one degree. This property of a body is called its "specific heat."

Quantity, as distinguished from degree, of heat is measured in terms either of "calories" or of "British thermal units." A "calorie" is the quantity of heat or thermal energy used to raise the temperature of one gram of water one Centigrade degree. This is the unit used in most scientific work. A British thermal unit (*B.t.u.*) is the quantity of heat used to raise the temperature of one pound of water one degree Fahrenheit. The B.t.u. is the heat used in most cases by American and British engineers. Thus we read in an engineering paper that a certain kind of coal "gives 13,000 B.t.u. per pound of coal." This means that the heat produced by burning a pound of this coal is enough to raise 13,000 pounds of water one degree on the Fahrenheit scale.

We know by experience that mechanical work can produce heat. Indeed, if our engines and machines are not properly oiled, we get heat at the expense of work when we do not want heat. The reverse question is: Can we turn heat into mechanical work? This is just what James Watt and other great engineers have done with such wonderful results for modern industry. The steam engine and the gas engine are the wonderful heat engines which get mechanical power from heat. It is the science of heat that has given us these marvelous engines to turn the heat stored in coal and oil and gas into power, to run our factories, to light our homes, and to transport our goods and ourselves across land and sea and through the air.

HEATHER. The song and story of Scotland are filled with praises of the "bonnie blooming heather," which clothes the rugged Highlands with a soft vesture of purple, and mingling its delicate fragrance with the atmosphere enters into the very life of the people as perhaps no other plant has done in any land. Of it one Scottish poet sings:

> O sweet is the breath of the heather
>   On braes of the Highlands that blows;
> O rich is its bloom when at evening
>   The hills glow in purple and rose.

The heather—or "ling," as it is sometimes called—is found not only in Scotland, but also throughout northern and western Europe. It is a small evergreen shrub, sometimes rising only a few inches above the ground, but often growing to a height of three feet or more. On its purplish brown stems are close-leaved green shoots and feathery spikes of tiny bell-shaped flowers, usually rose-lilac in color, but ranging from deep purple to pure white. White heather, which is somewhat rare, is the most prized of all, and in Scottish superstition this beautiful plant is regarded as a bringer of good luck.

Not only does this hardy plant lend beauty to the landscape, but it serves many useful purposes. The tops afford winter forage for Highland sheep and cattle. The flower is a favorite of the bee and heather honey has a delicious flavor. The larger stems are made into brooms, the smaller into brushes. Owing to the scarcity of wood, the Highlanders in former times built their "shielings" or cabins of heather stems cemented with mud, and used it as a thatch; and heather laid on the ground with the small twigs uppermost formed a comfortable bed for the warrior, as it still does for many a shepherd and hunter.

The common heather (*Calluna vulgaris*) belongs to the family of plants called heaths (*Ericaceae*), from the fact that they grow on open tracts of poor and uncultivated land. There are more than 400 species, the greater number being found in South Africa; some of these species have flowers of large size and brilliant color. Other varieties grow in the Mediterranean region in Europe, and one of these (*Erica scoparia*) is used in making the so-called "briarwood" pipes. Heather like that of Scotland has been found in the eastern part of North America, but many scientists think it was introduced by early settlers. African species are sometimes cultivated as a garden or hothouse plant.

ARTIFICIAL CLIMATES *for Our Buildings*

Ingenious Equipment that Turns Winter into Summer in Our Homes, Offices, and Public Buildings—How the Heating Engineer Conquers Cold

HEATING AND VENTILATION. "We deliver climates —hot or cold, wet or dry." This advertising boast of one of America's great makers of heating and ventilating equipment gives an idea of the wonders of this recent development of science. Until Benjamin Franklin invented the closed iron stove, the open fireplace was almost the only method of heating known, and this primitive and wasteful method is still the one used in most of the homes in England. But throughout the United States and Canada, heating by hot air furnaces, and by hot water or steam conducted through cast iron pipes has been so perfected that our homes and public places can now be kept at almost any temperature desired, regardless of the weather conditions. Furthermore, the related problem of obtaining sufficient supplies of fresh air has been worked out so completely that wherever homes or public places are badly ventilated, you can lay the fault to ignorance or carelessness.

The human body is continually manufacturing heat from the food it receives, but when the air is cold this heat escapes from the body faster than it can be produced. Hence clothing is necessary to prevent the heat from being given off too fast, and in cold climates dwellings must be artificially heated to supplement the heat of the body. To allow the bodily temperature to sink below normal (98.2 degrees Fahrenheit) weakens vitality.

The artificial temperature required to maintain the body in comfort and health varies with the individual's constitution and habits and age, but physicians consider a temperature of from 65° to 70° the most desirable. In England and most of the other temperate and cold regions of the world, people accustom themselves to home temperatures of 60 degrees or less. In the United States and Canada a higher temperature—70 degrees or more—is usually demanded.

To live in too high an artificial temperature is just as unhealthful as living in one too low. The great prevalence of colds, pneumonia, and throat affections in the United States is attributed largely to the habit of living in overheated rooms and offices. The body is weakened and rendered abnormally sensitive, so that it cannot properly perform its functions when it is suddenly exposed to the colder air outside.

Overheating is especially likely to occur where not enough attention is given to keeping the air properly moist or *humidified.* Dry air introduced into a room takes up moisture from plants, furniture, and the human body, with the result that the plants die, the furniture warps and cracks, and human beings feel chilly and their throats and skins become dry and irritated. To make one feel comfortable in a dry atmosphere the temperature may have to be raised to 75 degrees or more, whereas with properly humidified air a temperature of 65 to 68 degrees will be sufficient for most persons suitably clad.

Getting Moisture into the Air

In modern furnace heating plants arrangements are made to introduce sufficient moisture by the use of evaporating pans. With steam and hot water systems it is harder to obtain proper humidity, for the common method of putting a pan on top of the radiators does not supply enough moisture. A large pan of water kept simmering on the kitchen range, with doors open to the rest of the house, will help; or a curtain may be suspended on a rod behind the radiator, with the bottom dipping in a pan of water. There are also various patent appliances on the market. Humidity is measured by an instrument called a *hygrometer*, one form being the wet and dry bulb thermometer. With such an instrument one can see whether the house has the proper relative humidity or not. Most American houses have only about half the humidity they should have.

Heating systems vary widely in efficiency. Most fireplaces allow seven-eighths of the heating value of the coal to be wasted up the chimney. Improved stoves, such as the base-burner, realize as much as 80 per cent of the heat value. Under ideal conditions, the hot air furnace will convert from 50 to 60 per cent of the value of the coal into useful heat. Steam and hot water systems are still more economical, and big heating plants scientifically constructed and tended realize 80 per cent of the coal value. It is claimed that a building that requires 12 tons of coal to warm it for a given time with a furnace will require only nine tons with the steam system, eight tons with hot water, and still less with the new vacuum or vapor methods. Such figures as these are of course not to be taken as absolute, as conditions will change them.

All methods of heating are classified as *direct* or *indirect* radiation. In direct radiation systems, the room is warmed by apparatus inside it, such as an open fire, a stove, or steam or hot water coils. In indirect systems the air is first warmed by a furnace, or by steam or hot water coils outside the room, and then brought in through an opening in the floor or wall called a register. A less common method is known as the *direct-indirect.* In this the steam or hot water coils are inside the room to be heated, but the air is brought directly from the outside into a sort of box at the base of the radiator and heated as it passes upward over the surface of the coils.

For small houses and buildings, the hot air furnace is still extensively employed. Such furnaces heat by indirect radiation. Cold air is brought by passages from outside the house or from one of the rooms, usually the hall; this is warmed as it passes over the heated surface of the furnace, and then distributed to the various rooms by a system of pipes, with registers which may be opened or closed to regulate the temperature. Furnace heating has the advantage of providing a constantly renewed air supply. It is open to the objections that more or less dust and fine ashes are brought up with the hot air, that upper rooms and rooms at a distance are harder to heat, and that its efficiency is affected by strong winds.

Hot water and steam heating systems employ a hot-water heater or steam boiler, a furnace, and a system of pipes and radiators. In the hot water system water heated to 140 degrees or more is circulated through the pipes on the principle that hot water is lighter than cold and therefore tends to rise.

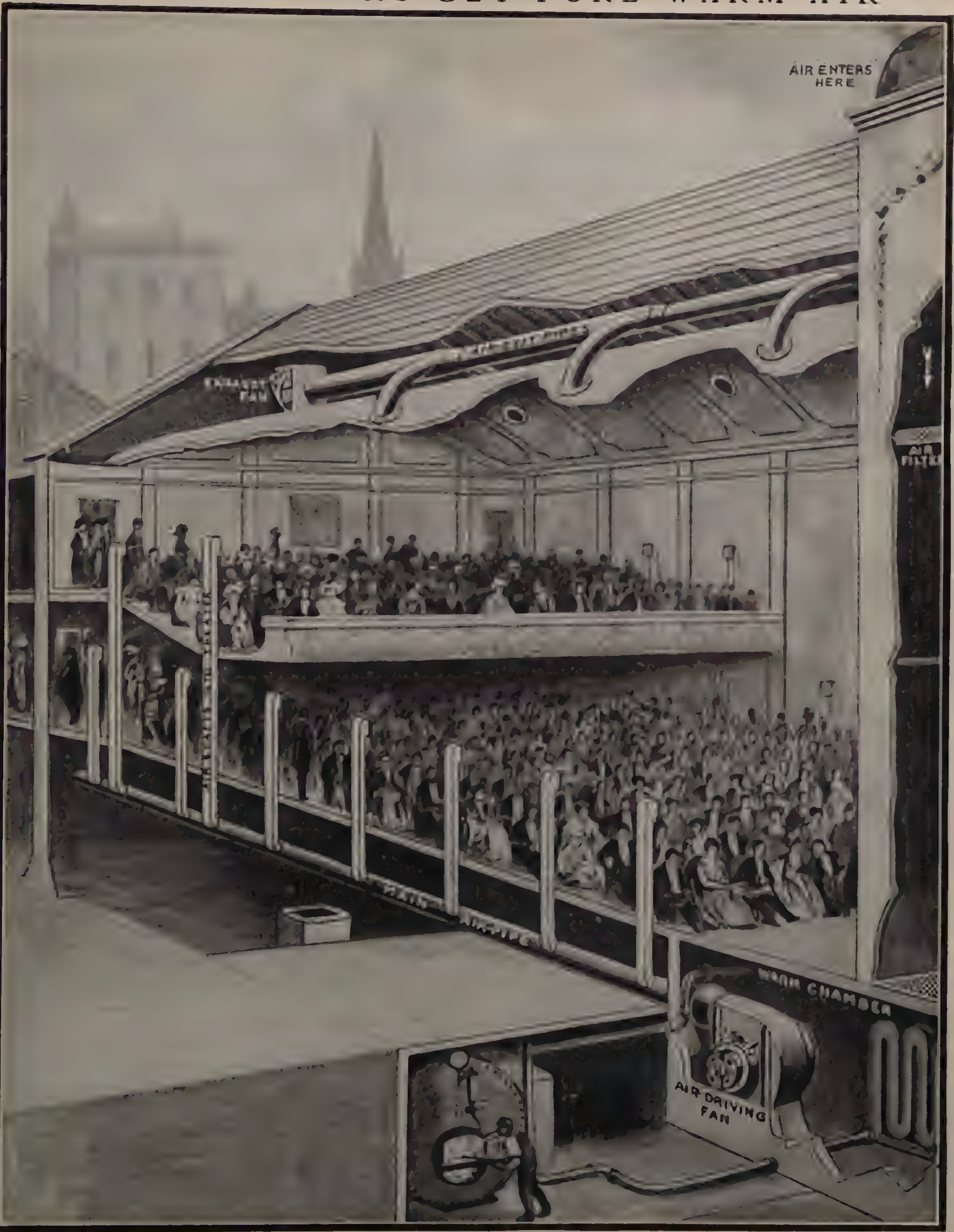
In steam heat, steam at a temperature of 212 degrees or more is circulated under pressure. When hot water is used, circulation begins and the radiators begin to give off heat as soon as the water is above the room temperature. In steam heat there is no heat in the radiators until the water in the boiler has been raised to 212 degrees and the steam has developed sufficient pressure to circulate in the pipes.

Hot water radiators give off only about two-thirds as much heat for each square foot of radiating surface as steam radiators do, so the pipes and radiators must be larger. The first cost of a hot water system is therefore greater than the cost of a steam heating plant. But it is cheaper to operate, for water will circulate with a very low fire and supply the amount of heat needed in mild weather, while with steam heating it is difficult to regulate the amount of heat in the radiators; usually there is all the heat the radiator will supply or there is none. Hot water radiators usually operate noiselessly, while in steam heating if not carefully designed the water sometimes condenses and lodges in pockets through which the steam has to force its way, thus producing a noise as if the pipe were being pounded with a hammer.

The Vacuum Heating System

The vacuum and vapor systems represent the most recent improvement in the art of heating. In steam heating a large part of the fuel has to be used to drive air from the circulating system. In *vacuum* heating the air is exhausted from the boiler and pipes so that the steam does not have to force its way against the pressure of the atmosphere. Furthermore, since the water is heated in a vacuum, steam is produced at a temperature as low as 98 degrees, instead of at the normal 212 degrees. The saving in fuel by this method is claimed to be 20 per cent over the regular steam system. *Vapor* heating is conducted on the same principle as vacuum heating, except that the apparatus is so contrived that the vapor produced from water below the normal boiling point—at about 90 degrees—is circulated before more than a few ounces of pressure is recorded by the gauge. In what is known as the *vacuo-vapor* system, the two

HOW THEATERS GET PURE WARM AIR



Here is a system widely used by heating and ventilating engineers for providing pure warm air in places where large numbers of people assemble. Huge steam-heated coils are placed in a small room near the boilers. Into this room fresh air is drawn from the outside, sometimes through water in order to wash it clean of dust. After the air has been heated by passing over the steam coils, it is pumped out by a huge electric fan and forced through a big main air pipe. From this main pipe, branch pipes rise which end in ventilators opening out into the walls or the floor of the theater. To make room for the fresh warm air, an exhaust fan draws out the old air through holes in the ceiling, thus keeping up a constant circulation. In hot weather a similar system, in which the air is cooled by passing over refrigerating coils, is often used.

principles are so combined that the system may be operated at any desired point, from the lowest pressure of vapor possible up to a considerable steam pressure, thus giving a range of temperature for the radiators from about 90 degrees to 240 or more.

In some cities central steam or hot water heating plants supply heat for homes and business houses within a certain zone. This arrangement of community heating is both convenient and economical.

Use of Electricity for Heating

Electric heating is quite generally used in streetcars. In this system the heat is developed by passing an electric current through wires that offer great resistance. It is an expensive system to operate since less than 10 per cent of the fuel value of the coal is transformed into heat. If electricity could be obtained cheaply enough it would be an ideal method of heating, but so far its cost has made it prohibitive for any general use.

Gas is burned in fireplaces, stoves, and furnaces, but except in those regions where natural gas abounds it is too expensive to be used for heating a whole house. Gas heaters and electric heaters, however, are often used to supplement the regular heating plant. Gas heaters are objectionable because they consume too much of the oxygen in the air and give off carbon monoxide. Electric heaters are used to a large extent in closed automobiles.

It has been estimated that the supply of fresh air for each person in an ordinary living room should be not less than 1,800 cubic feet an hour. This means that in a room 12 by 10 feet and 10 feet high, in which there is only one person, the air should be changed every forty minutes. Where this is not done vitality is lowered, one feels chilly and sleepy, and often suffers from headache. Proper ventilation is especially important in sleeping rooms. Windows should be raised from the bottom and lowered from the top to provide a circulation of air even in the coldest weather. If the wind is too strong, screens may be used. In ordinary dwellings nearly enough fresh air is usually supplied by so-called natural ventilation, that is, by the drafts through doors, windows, etc.

In schools, theaters, churches, and hospitals, the allowance of fresh air should be greater than in an ordinary living room. This may be provided by drawing out the impure air (the *aspirating* system) or by forcing in fresh air by blowers (the *plenum* system). The latter method is more successful. The newer schoolhouses have very elaborate systems of ventilation which add greatly to the pupil's health and comfort, but in the rural districts many of the schoolhouses have no special device for ventilation and the air becomes very impure in a short time. It is one of the important duties of the teacher to meet this condition by raising all the windows during the intermissions and by using screens or boards fitted to the casing under the lower sash which will deflect the cold air upwards from the heads of the pupils when the windows are raised.

It is known with reasonable accuracy just how much heat will be lost by the windows, the outside walls, etc., and how much fresh air will have to be heated with proper ventilation. So, from the plans of the building, it is possible to figure with considerable accuracy just how large a heating plant will be necessary in a given climate.

The *thermostat* is a device used to regulate temperature automatically, and sometimes to sound an alarm when the temperature rises to a given point. The simplest of these devices is the ordinary mercurial thermometer. In this the upper end of the tube is not hermetically sealed, but is closed by an airtight plug of rubber, through which passes a metallic rod. Whenever the expanding mercury reaches the end of the rod, an electric circuit is closed and the current sets off an electromagnet, which opens or closes a register or regulates the draft in the furnace. A fire-alarm or a fire-sprinkler apparatus may be operated in a similar way.

HEBE (*hē'bē*). In the Greek mythology this goddess Hebe typified eternal youth and joyousness. She was a comely maiden, with sparkling eyes and rounded form, ever smiling; and Milton in his famous poem 'L'Allegro' speaks of—

> Nods, and becks, and wreathed smiles,
> Such as hang on Hebe's cheek.

She was the daughter of Zeus (Jupiter) and Hera (Juno) and served the gods as cupbearer, until one day she tripped and fell. Then the lovely youth Ganymede took her place, and Hebe became the wife of Heracles (Hercules).

HEBREW LANGUAGE AND LITERATURE. To most persons of European descent the chief representative of the Semitic tongues is Hebrew, the sacred language in which most of the Old Testament was written and in which its Scriptures are still read in the Jewish synagogues. The Semitic languages (a group of Asiatic and African tongues) are divided into two great branches, the northern and the southern. To the former belong Hebrew, Phoenician, Aramaic, and Assyrian, while Arabic and Ethiopic are of the second group. Hebrew and Phoenician are so closely related that they are considered as dialects of one tongue.

The Hebrew language is very ancient and was spoken in Palestine as early as 2000 years before Christ. The words are short, for the most part, and the grammar and sentence construction are simple. Much is expressed in a few words, and though often rude, the language is full of strength and grandeur, with a deep sonorous quality that makes it well suited to poetry and the expression of the deeper religious feeling. In common with other Semitic tongues the parts of speech are derived from roots or word-stems having three letters. Originally the Hebrew alphabet was made up entirely of consonants and the vowel sounds were omitted. Early in the Christian Era, however, vowel signs were inserted underneath the consonants as is done today in some systems of short-hand. The writing reads from right to left, like Chinese, and from the back of the book to the front.

With the exception of parts of the books of Daniel, Ezra, and one verse in Jeremiah, which are Aramaic, the entire Old Testament is written in Hebrew. This and a few inscriptions are all that remain to us of ancient Hebrew literature. In their daily speech the Jews came gradually to use the Aramaic language of their Syrian neighbors, but Hebrew was preserved as a religious and literary language. In the first four or six centuries of the Christian Era there grew up a great body of writings known as the *Talmud* (meaning "teaching" or "learning"), consisting of two parts. The first of these, the *Mishna* or oral law, was written in Hebrew; and the second, the *Gemara* or commentary on the law, in Aramaic. The Mishna is a systematic collection of religious-legal decisions, developing the laws of the Old Testament. The Gemara is a great unordered mass containing arguments and opinions on the law, and much miscellaneous material—a "literary wilderness," it has been termed. Long discussions and hair-splitting arguments are often interrupted by charming tales and parables. In its pages are poems, prayers, anecdotes, and maxims, together with science and mathematics; tears and laughter are mingled, while side by side with the investigations of the learned are the wisdom and superstition of the unlearned. Despite its faults, the Talmud is a very great work. It formed a bond between the scattered Jews and kept alive their learning during the Dark Ages, making it possible for them to play a large part in the restoration of learning and the cultivation of science at the time of the Renaissance.

In the Middle Ages arose a body of literature embodying what is called the *Cabala*, a mystical interpretation of the Scriptures based on the assumption that every letter and number has a hidden meaning.

From early days the Jews have adopted the language of the country in which they happened to dwell. Even in the 1st century B.C., Josephus, the great Jewish historian, had written for the most part in Greek, probably because he could thus reach the greatest number of readers. His immortal 'History of the Jewish War' was written first in his native Aramaic and then in Greek, but only the Greek version has come down to us. Moses ben Maimon, or Maimonides, as he is generally called, the great Spanish Jewish rabbi, philosopher, and physician of the 12th century, wrote mainly in Arabic.

The Jews in Germany adopted German as their language, but they wrote it in Hebrew characters; and when persecution drove great numbers of them to the countries of eastern Europe, they carried this language with them. Mixed with some Hebrew and Slavic words, and written in Hebrew letters, this German dialect developed into the language known as *Yiddish* (from the German *jüdisch*, Jewish). It is widely used today among the Jews of Bohemia, Galicia, Lithuania, Russia, and other countries, being slightly modified by the addition of words from the languages with which it has come in contact. Within the last century, particularly, quite an extensive literature has developed, and there are a large number of newspapers and periodicals in Yiddish, in the United States as well as in other countries.

Although Hebrew ceased to be a spoken language, as a literary language it has never entirely died out, and in recent times there has been a revival of interest in it, as a means of communication between Jews in various parts of the world. Periodicals and books are appearing in Hebrew, which is now recognized as one of the three official languages of Palestine.

HEBRIDES (*hĕb'rĭ-dēz*) **ISLANDS.** Shortly before his death in 597, St. Columba the Irish missionary looked out upon the tiny island of Iona, one of the Hebrides or Western Isles of Scotland, and uttered a memorable prophecy. "Unto this place, albeit so small and poor, great homage shall be paid not only by kings and peoples of the Scots, but by the rulers of barbarous and distant nations, with their people also." And so it was. For this island of only five square miles became, through the work of St. Columba and his disciples, the most famous center of Celtic Christianity. From it missionaries were sent for the conversion of Scotland and northern England, and to it for centuries students flocked from all parts of the north. Kings and chiefs were brought to it for burial that their dust might mingle with that of the "blessed isle." From the end of the 6th to the end of the 8th century Iona's fame was scarcely second in importance to any of the British Isles. Then the Vikings swept down from the north, and not until the 13th century did the Norwegian kings give way to the Scottish kings.

Semi-feudal conditions continued until 1748, under the rule of native chieftains. Great depression followed the changes then introduced; rents became excessively high and large numbers of the tenants emigrated to North America. The potato blight in 1846 brought practically the entire population to the verge of starvation. Thousands were removed to Australia. Since then the system of land tenure has been revised and the hardships of the inhabitants' lot have been greatly lessened.

These islands off the west coast of Scotland are divided into two groups, the Outer and Inner Hebrides, by the ocean waterways of the North Minch and Little Minch. The most important of the Outer Hebrides are Lewis-with-Harris, North and South Uist, Benbecula, and Barra; of the Inner Hebrides, Skye, Rum, Coll, Tiree, Mull, Colonsay, Jura, Islay, Arran, and Bute. Altogether the Hebrides number over 500, but only 120 are inhabited. Of the total area of 2,812 square miles, only one-ninth is cultivated, the rest being moorland and mountain. Sheep-farming, cattle-raising, herring fishing, distilling, slate quarrying, and the manufacture of Scotch woolens provide the main occupations of the people. While the country is poor, the scenery is wild and picturesque, and numerous tourists add materially to its prosperity. Population, about 79,000.

HECATE (*hĕk'ă-tē*). The dark mysterious Hecate of the Greek mythology was a moon-goddess. As Artemis (Diana) represented the moonlight splendor of night, so she represented its darkness and terrors. She is often pictured with three bodies standing back to back, probably to typify the three phases of the moon. Hecate was also sometimes conceived as goddess of the underworld, frightful in appearance, with serpents in her hair and about her feet, carrying a lighted torch, and attended by two dogs. In this rôle she was worshiped especially by sorcerers and magicians. Shakespeare in 'Macbeth' represents the witches as aided by Hecate.

HECTOR. "Glorious Hector," the ideal hero of the Trojans, was the son of King Priam and Hecuba and the husband of Andromache. In the 'Iliad', Homer tells the story of Hector's valor during the siege of Troy by the Greeks, and of his death by the hand of Achilles. To avenge the slaying of his friend Patroclus, by Hector, Achilles tied Hector's body to a war chariot and dragged it around the walls of Troy, as is told in the accompanying story article. Hector is represented not only as a brave warrior, but as a devoted son, husband, and father. One of the most beautiful passages in the 'Iliad' is that which describes his final parting from his wife and infant son.

The Death of Hector

" 'My soul forbiddeth me to shrink away from battle like a coward', Hector answered, and he stretched out his arms to his boy. But the child shrank crying to the nurse, frightened at the gleaming bronze and the horse-hair crest that nodded fiercely from his father's helmet. Laughingly, the great warrior swept the helmet from his head, and taking his son in his arms, kissed him and prayed to the gods that he might grow to be a great man."

HIGH on the great tower of Troy stood the white-armed Andromache (*ăn-drŏm'ȧ-kē*), wife to Hector, bravest of the Trojan warriors. By her side stood a nurse bearing his infant son Astyanax (*ăs-tī'ă-năx*). All day long the dreaded Greeks had been pressing her countrymen hard, and she looked out over the plain before the city, weeping and wailing like one frenzied, for she feared the coming disaster.

Suddenly she caught sight of her dearly loved husband, who had come to the city to bid the elders and the women pray to the gods for help. Andromache ran swiftly to meet him and with her went the nurse and the child. She clasped her hand in Hector's and begged him with tears not to return to the battle.

"Come now, have pity and abide here upon the tower, lest thou make thy child an orphan and thy wife a widow."

But Hector of the glancing helmet could not be turned from the path of duty. "My soul forbiddeth me to shrink away from battle like a coward," he answered, and he stretched out his arms to his boy. But the child shrank crying to the nurse, frightened at the gleaming bronze and the horse-hair crest that nodded fiercely from his father's helmet. Laughingly, the great warrior swept the helmet from his head, and taking his son in his arms, kissed him and prayed to the gods that he might grow to be a great man.

With the return of Hector, the sun-god Apollo befriended the Trojans. So it was that, with the aid of this swift-arrowed deity, Hector killed Patroclus, the most loved of the friends of Achilles, who was the greatest warrior in Greece. Because of this, Achilles swore vengeance and went out to battle with the mighty Hector.

Once more, when Achilles entered the fight, the tide turned for the Greeks, and they swept the fleeing Trojans back to the gates of Troy. The massive portals closed, and all the Trojans were safe inside save Hector, who stood without the wall awaiting the coming of Achilles.

Now Hector was the bravest man in Troy, but when he saw Achilles, godlike and terrible in the shining armor which Hephaestus (Vulcan) had made for him, his heart was filled with a great fear and he fled. Three times around the city they ran, and neither lost or gained. As they came near for the fourth time, to the hot and cold springs where the maids of Troy were wont to wash their garments, the goddess Athena (Minerva), who loved the Greeks, whispered to Achilles to stop and take breath. She promised to bring about his meeting with Hector. Then she went to Hector, and taking the shape of Deïphobus, Hector's brother, said to him, "Wait, and we shall meet Achilles together. Thus shall you slay him."

Hector took heart and closed with Achilles. The Greek threw his spear, but Hector bent low and it flew past him. The goddess Athena returned the spear to Achilles, but Hector did not see this and, throwing his own spear, struck the shield of the Greek. It bounded back from the god-made armor. Turning to seize a second spear from Deïphobus, Hector found him gone, and knew that a god had tricked him. So, certain that he must die, he drew his sword and rushed toward Achilles, but the famed warrior bore down upon him like an eagle. His armor shone like the sun, and his spear-point gleamed as the evening star in the darkness of night.

With one thrust, Hector lay dead at the feet of Achilles. To take full vengeance for the death of Patroclus, Achilles fastened the body of Hector to his war chariot and dragged it round the wall of Troy. Andromache fell fainting into the arms of her maidens, as she stood on the wall and looked upon the dishonor done to the body of her husband.

Great was the weeping in Troy that the body of Hector had come into the possession of the enemy, for Achilles' heart was wroth and he would not give it up for any ransom.

Then to Achilles came his goddess-mother Thetis. "I am the messenger of Zeus (Jupiter) to thee, my son. The gods are displeased at thee because thou holdest Hector and hast not given him back. Come, restore him and take ransom for the dead."

And Zeus sent a messenger to King Priam, saying: "Be of good cheer, O Priam. Zeus, though he be afar off, hath great care and pity for thee. He biddeth thee ransom noble Hector and carry gifts to Achilles that may gladden his heart."

Hermes (Mercury), the wing-sandaled messenger of Zeus, guided Hector's aged father to the camp of the enemy. In return for gold and rugs, mantles and cloaks and caldrons, Achilles gave up the body of Hector.

There was a nine-day truce between the Greeks and the defenders of Troy, while the Trojans wept and mourned over Hector. With many tears they burned the body of their dead hero on a lofty pyre, and then buried his bones under a great mound of stones. "Thus held they funeral for Hector, tamer of horses."

—*Retold from Homer's 'Iliad', Books* vi, xxii, xxiv.

HEDGEHOG. The true hedgehog is common in Europe and, as indicated by its name, dwells in the hedges and thickets, rooting in the mold with its pointed snout for insects, snails, eggs, and the like, on which it feeds. When attacked it rolls itself into a ball, thus exposing no part of its body that is not defended by its sharp prickly spines. The common hedgehog of Europe (*Erinaceus europaeus*) is about the size of a large rat and other species exist which are even smaller. About 19 species exist in all, some of which lack the spines.

No true hedgehogs live in America, but the name is sometimes given to the porcupine of the United States and Canada, for though much larger than the hedgehog it too has its hairs modified into a coat of stiff sharp spines.

This little Hedgehog was frightened when he was picked up, and rolled himself into a tight ball. But now he's getting over his fright and peeking out.

HEDGES. These "fences of living green" are used for two purposes, defense and ornament. In the Old World they are still much used to protect fields in countries where wood is scarce, but in the New World the wire fence has replaced the hedge in usefulness.

No plant meets all the requirements of the farmers for an absolutely impassable barrier, although the Osage orange (*Maclura aurantiaca*) was widely planted at one time in the United States. Next to this, probably, ranks the honey locust (*Gleditschia triacanthos*), with its spiny trunk and branches, and its large flat ornamental pods, whose sweet pulp gives the tree its name. The hawthorn of Europe (*Crataegus oxyacanthus*) is subject to many fungus growths and is consequently not planted to any extent in America. A thorn hedge requires constant attention, for it must be kept free from weeds and pruned systematically.

The California privet (*Ligustrum ovalifolium*) is a general favorite where the winters are not too severe, as it holds its leaves nearly all winter and grows so close after repeated pruning as to form an almost impenetrable barrier.

Among the evergreens used for hedges the Norway spruce (*Picea excelsa*) is a great favorite. Next perhaps rank the American arbor-vitae (*Thuja occidentalis*), often incorrectly called white cedar, with its short horizontal branches ascending at the end, and the common hemlock (*Tsuga canadensis*), the only one of the hemlocks that bears pruning well. The boxwood (*Buxus sempervirens*) is much used in the old formal gardens of Europe, and is sometimes trimmed in most fantastic shapes.

Many deciduous trees and shrubs also can be used for ornamental hedging. The flowering shrubs are especial favorites. Some of the most common are the varieties of *Spiraea* (bridal wreath), the Japanese rose (*Rosa rugosa*) which bears its single flowers all through the summer, the common lilac (*Syringa vulgaris*), and the great panicled hydrangea (*Hydrangea paniculata*). Several species of barberry (*Berberis*) are beautiful and hardy, especially the charming *Berberis thunbergii*, with its low dense growth, its brilliant autumnal tints, and the abundant scarlet berries which remain fresh until the following spring. Many species of barberry, however, are under ban owing to the enormous injury they do in harboring the rusts which blight the wheatfields (*see* Rusts and Smuts).

HEIDELBERG (*hī′dl-bĕrḡ*), GERMANY. Nestling between a wooded height and the beautiful Neckar River, which here leaves its gorge to enter the plain of the Rhine, this quaint university town is one of the most picturesque and interesting spots in Germany. The old city consists principally of a long narrow street following the course of the river for about two miles. It grew up at the foot of the castle begun in the 12th century, which crowns the wooded height in the background. Added to at different periods the castle became one of the largest and grandest in Germany; but it was largely destroyed during the devastating wars of Louis XIV of France, and though later rebuilt, it was struck by lightning and again ruined in 1764. But its ivy-clad ruins are still beautiful, and in an old cellar beneath the castle is the great "Heidelberg tun," an enormous wine cask capable of holding 49,000 gallons. The terrace commands a magnificent view of the surrounding country. Heidelberg University, which has been the alma mater of many noted scholars, was founded in 1385, and it is the oldest of German universities. Formerly the capital of the Palatinate, Heidelberg passed to the former grand duchy of Baden in 1803. Population, about 61,000.

HEINE (*hī′nĕ*), HEINRICH (1797–1856). "I am a Jew—a Christian. I am tragedy—I am comedy." This is what the most gifted poet in the Germany of his century said about himself. Heine was indeed a man of puzzling contradictions and inconsistencies, a true poet and a splendid journalist, a historian without method, a philosopher without a real philosophy, a hater of despotism and an ardent admirer of Napoleon, a cynic who laughed at sentiment, but was himself a sentimentalist. He was born of Jewish parents in Düsseldorf, in western Germany, but later joined the Lutheran church in order to practice his profession of law, which he had studied at the universities of Bonn and Göttingen.

Heine's heart, however, was in literature, not in law. During a visit to a wealthy uncle, his lifelong benefactor, he fell in love with a very beautiful cousin. His spurned love found expression in exquisite poems which were published and created a sensation in Germany. His outspoken liberal views together with his intense admiration for Napoleon made him feel uncomfortable in reactionary Germany. This disappointment in love and his political opinions combined to send him to Paris, where he felt at home.

Although Heine wrote much about philosophy, literature, and politics, his fame rests on his poems. Many of these lyric gems have achieved the popularity of folk-songs, and with good cause, for they have the true folk-song qualities. They are simple and full of warmth, and have the freshness and melody of the skylark's note. Almost every German man, woman, and child knows several of Heine's poems by heart. Some of them, such as 'The Lorelei' and the 'Two Grenadiers', are universally famous. His songs have been set to music by many famous composers. The capricious quality that pervades all his writings lurks even in his most tender poems. He shifts from intense passion to careless mockery. One of his delightful poems, 'My Child, We Once Were Children', pictures two children playing house in the courtyard and entertaining company, amongst them the neighbor's cat; and the sweet, pensive mood of the poem is broken by the satiric stanza:

> Politely we asked how her health was,
> In the course of a friendly chat.
> (We've said the same things since then
> To many a grave old cat.)

But it is in his prose writings that Heine's most sardonic flashes of wit appear. The 'Travel Pictures', the most popular of all of Heine's prose writings, strikes a new and fresh tone and is full of sparkling wit. The prologue rings out mockingly at the "laundered bosoms," "polished salons," and "oily speeches."

The nervous headaches of his university days at length developed into a disease of the spine which resulted in paralysis. This strange man of contradictions, who had been impatient and irritable in health, showed remarkable endurance and cheerfulness in the long years spent on what he termed his "mattress grave." He died and lies buried in Paris.

Heine is perhaps best known to American readers by his poem entitled 'The Lorelei', familiar to us as a German song. The poem suggests that dreamy time just before the approach of twilight. The sunset in a burst of glory lights up the mountain peaks. A boatman is returning home on the Rhine; he looks up and beholds a glorious sight:

> On yonder height there sits
> A maiden wondrous fair,
> Her golden jewels sparkle;
> She combs her golden hair;
> With comb of gold she combs it
> And sings, so plaintively,
> A strain of wondrous beauty,
> A potent melody.

Drawn by the enchanting power of her song, the boatman gazes upward at the beautiful maiden and fails to see the dangerous rocks below. Suddenly there is a crash, and boat and boatman are lost in the waves.

In this story Heine makes use of an old legend which had grown up about a high and dangerous rock on the bank of the Rhine, called the Lorelei or "elf-rock." It is at a narrow part of the river, about 23 miles south of Coblenz, near St. Goar. The rock has a remarkable echo, and it is from this probably that the legend of the enchanting song arose.

HEL'GOLAND. "The Gibraltar of the North Sea" is the phrase which before and during the World War of 1914–18 described this tiny island in the angle formed by the Danish peninsula and the German coast. Immense guns, masked behind powerful fortifications, protected the western entrance to the Kiel canal, as well as the mouths of the Elbe and Weser rivers and the port of Wilhelmshaven. With the batteries only 30 miles away, and the adjacent waters sown with death-dealing mines, these guns established a protective zone behind which the German high-seas fleet long lurked. By the peace terms of 1919 Germany was compelled to dismantle the fortifications which had made the island impregnable. The inhabitants are chiefly Frisian fishermen.

Helgoland (or Heligoland, as it is sometimes called) belonged to Great Britain from 1814 to 1890, when it was ceded to Germany in return for the surrender of certain rights in Africa. In ancient times, when it was a resort of sea-rovers, it was five times larger than the mile length and third of a mile breadth to which the constant pounding of the sea has now reduced it.

HELIOTROPE. "The flower enamoured of the sun" is what the poet Thomas Moore called the dainty heliotrope, which got its name from the Greek words *helios* (sun) and *trope* (turning) because its one-sided spikes of small fragrant flowers were supposed always to turn toward the sun. In the 18th century a French botanist sent some of its seed from Peru to the royal garden at Paris, where, according to chroniclers, women "welcomed it with enthusiasm, according it their most precious vases, naming it the 'flower of love', and receiving with indifference all bouquets in which their favorite found no place."

Many wild species of these hairy many-branched shrubs are found in the warm and temperate regions of the world, and many cultivated varieties give an added charm to greenhouses and gardens. They grow from one to two feet high, with flowers varying in color from purple to violet and even white. Because of their vanilla-like odor the flowers are used in making perfume and sachet powder.

The heliotrope is a genus (*Heliotropium*) of the borage family (*Boraginaceae*) which has about 220 species in the temperate and warmer parts of both hemispheres. The Peruvian heliotrope (*Heliotropium peruvianum*) is the most common. The lance-shaped leaves are alternate and petioled; the tiny flowers grow in one-sided curved spikes; the calyx is five-parted, the corolla salver-shaped.

HELIUM. Before scientists knew that the gas helium existed on earth, they had discovered it with the spectroscope on the blazing surface of the sun—hence its name, from the Greek *helios* meaning "sun." Strangely enough, this namesake of the hottest body known to man has since been used to produce the most intense cold ever observed. When helium is turned into a liquid, under immense pressure, and then allowed to evaporate, it generates a temperature of 454 degrees below zero F., only five degrees above the point of absolute zero (*see* Heat).

Helium is the lightest of inert gases—that is, those that refuse to combine chemically with other substances. Because it will not burn it is especially adapted for use in balloons instead of hydrogen, which is highly inflammable. In the World War of 1914–18 the United States attempted to produce this gas in quantities for this purpose. Up to 1915 the world's total output of helium was probably less than 100 cubic feet, and its market value was about $1,700 a cubic foot. Scientists, however, had discovered that helium occurs in some of the natural-gas fields of Kansas, Oklahoma, and Texas, and plants were erected for its extraction. The process consists in refrigerating the natural gas under very high pressure, and then allowing it to expand. As it expands it becomes so cold that all of its constituents become liquid except helium, which is easily separated. Helium can thus be produced for about 10 cents a cubic foot, and quantity production to supply the balloons used on the American front in France had just begun when the fighting ended in 1918.

Helium exists in very small quantities in the atmosphere, in volcanic gases, and in gases from mineral springs. In addition, it is generated by radium, that amazing element which is constantly breaking down and producing other substances; some scientists believe that all the earth's helium has been derived from this source (*see* Radium).

HEMLOCK. Its plumelike and drooping branches and short flat blunt needles, whitened beneath and appearing two-ranked, afford a sure means of distinguishing this beautiful evergreen tree from its relatives, the pines, the firs, and the spruces. The tiny oval brown cones hanging from the branches are usually only about half an inch long. When the tips of its dark-green sprays are all alight with the yellow-green of the new leaves in spring, the hemlock is one of the most picturesque of American trees.

Hemlocks are tall and pyramidal in shape; they grow to an average height of 60 or 70 feet. With the growing scarcity of pine, the wood has come to be used extensively in interior decoration, although it is soft and warps when exposed to the air. The bark is extensively used in tanning.

There are two chief species: the Canadian hemlock, found in eastern Canada and in the United States as far south as Georgia and as far west as Minnesota; and the western hemlock, found on the Pacific coast and as far east as Montana.

The name "hemlock" is also applied to a family of poisonous plants native to Europe and parts of Asia, and extensively naturalized in North America. It is often mistaken for parsley, which it closely resembles. A sure means of distinction is the disagreeable mouse-like odor of the hemlock plant when it is bruised. The Greeks used this poison to kill criminals; the philosopher Socrates was thus executed.

THE CANADIAN HEMLOCK

On the right is the trunk of the Canadian Hemlock. On the left are hemlock branches with their short flat blunt needles, their oval cones, their winged seeds that help the Hemlocks to march into new territory, and to climb so high on the mountain sides.

Scientific name of Canadian hemlock, *Tsuga canadensis;* western hemlock, *Tsuga heterophylla.* Bark reddish or gray, becoming furrowed with age. Leaves linear, ½ inch long; growing singly and opposite each other. Cones very small and thin-scaled. Fruit winged seeds.

HEMP. Since very early times the fiber of the hemp plant, a native of temperate Asia, has been employed in making coarse cloth and rope, and today its cultivation is an important industry in China, India, various parts of Europe, and the United States. In India and China hemp is cultivated not only for its fiber, but for its flowers and leaves from which is prepared an intoxicating drug, called "hashish." Russia, Italy, and France are the chief producers of hemp in Europe; in the United States the largest crops are grown in Kentucky, Wisconsin, California, and South Dakota.

From the close of the Civil War until a few years ago, Kentucky was the only important hemp-producing state. Production remained almost at a standstill and the United States imported about half its supply from Russia and Italy. The crude and primitive methods of harvesting the crop and preparing the fiber required an enormous amount of labor. Everything was done by hand, as is still the practice in Europe. The crop was cut with hand sickles, spread out on the ground to be "retted" by the weather for several weeks, gathered and bound in shocks by hand, and finally crushed in a heavy wooden hand-brake to separate the fiber from the wood of the stem. "Braking" by hand is an especially tedious and laborious task; 100 pounds of cleaned fiber is a good average day's work for a man.

Since 1916, however, production in the United States has grown by leaps and bounds, chiefly as the result of the introduction of machinery. Crops are now harvested by an ingenious machine which spreads the stalks in even swaths. Another machine gathers and binds them when they have been retted. The crushing is done in power-brakes with fluted rollers, and the fiber is removed in a scutching machine.

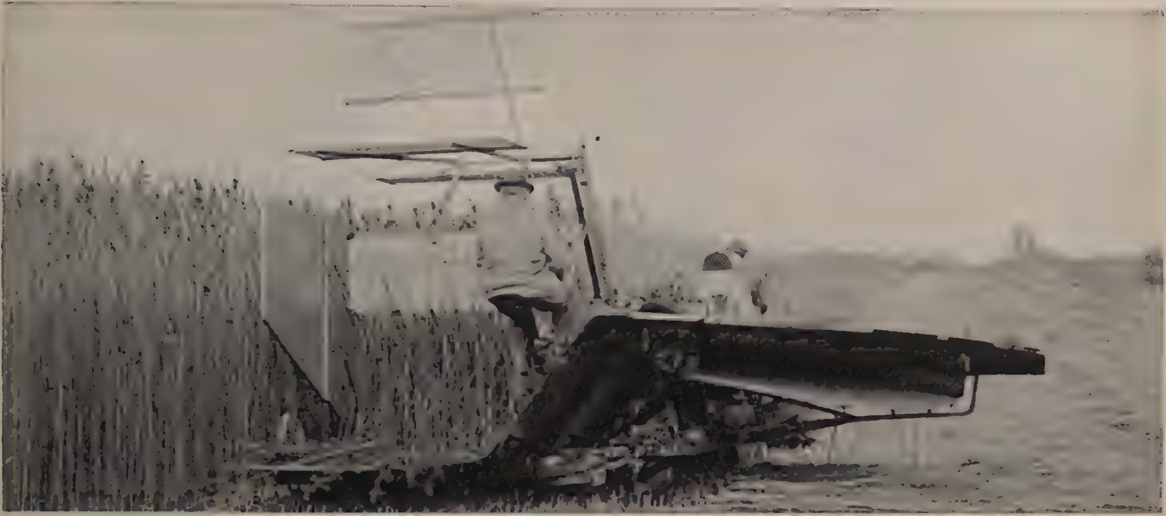
Hemp fiber, which comes from the inner bark of the stem, is valuable because of its length, toughness, pliability, and resistance to water. American dew-retted fiber is grayish and rather coarse but Italian fiber, which is retted by soaking in soft water, is soft, lustrous, and almost white.

Hemp is chiefly used for making rope, twine, shoe and harness thread, and the coarse cloth known as gunny-sacking. At one time it was used extensively in the manufacture of sail cloth and sheeting, and some of the finer quality is still made into cloth in China and Japan. Hemp seeds produce an oil which is used in the manufacture of soap and varnishes. They are also used for bird-seed.

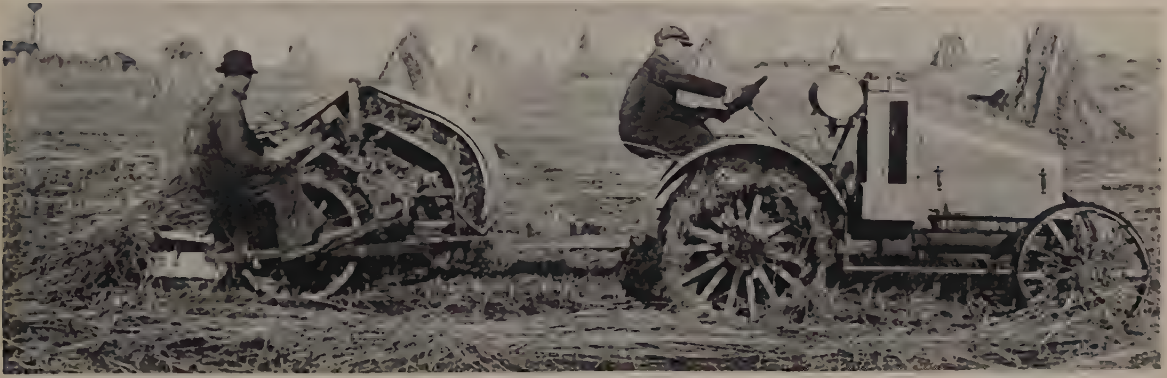
The term hemp is also used to designate many kinds of fiber in no way related to the hemp plant—among them Manila hemp, sisal hemp, and the Sunn hemp of India. Manila hemp is a product of the Philippines and is obtained from a species of banana plant. Though not so strong as the true hemp, it is noted for its length (six to ten feet), smoothness, glossiness, and softness, which make it ideal for rope-making. Its high price has led to the development of the sisal hemp, a cheaper, shorter, stiffer fiber extracted from henequen, a cactus-like plant of Yucatan, which has come into common use in spite of its inferiority.

All cultivated true hemp is produced from *Cannabis sativa,* an annual herb of the mulberry family varying under cultivation from 3 to 16 feet in height and having angular rough stems and alternate deeply lobed leaves. The male and female flowers grow on separate plants, the female plant being taller and more luxuriant and having darker foliage than the male. Manila hemp comes from the *Musa textilis.* (*See* Rope and Twine.)

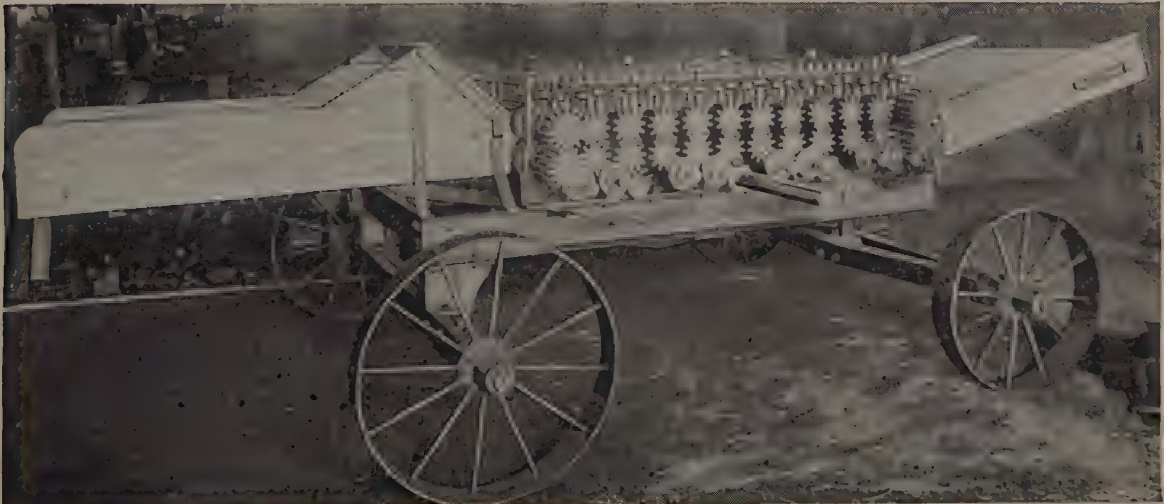
HARVESTING THE "ROPE" CROP



The hemp harvesting machine cuts an even swath, passes the stalks up to the table on the right of the driver, and from there distributes them over the ground in even windrows. They lie in this way on the ground until they have been "retted," that is, decayed by moisture and exposure so that the woody portions separate from the fiber.



This machine gathers the hemp stalks from the windrows and ties them into bundles ready to be shocked. Notice the shocks already set up in the background.



This complicated gear-driven machine separates the hemp fiber from the woody portion of the stalks. The rollers of the machine are fluted so they will properly crush the stalks as they pass through. Once crushed, the stalks pass on to the "scutcher" which combs out the fiber from the woody pulp.

HENNEPIN, Louis (1640?–1706?). "Anybody but me," boastingly writes Father Hennepin, "would have been very much frightened at the dangers of such a journey as that upon which La Salle now dispatched me." This journey was to be from Fort Crévecoeur, near the present site of Peoria, Ill., down the Illinois River to the Mississippi, and thence up the Father of Waters towards its source.

The man to whom was confided this undertaking was a Franciscan monk from Belgium. He had come to America in 1675 on the same ship that brought La Salle. Love of adventure and religious zeal led him to become a missionary to the Indians, and in 1678 he was overjoyed when he was given permission to accompany La Salle on his great trip of exploration.

Two years later he set out on his dangerous journey from Fort Crèvecoeur. And dangerous it proved, for Father Hennepin and his two companions were captured by the Sioux Indians and carried in canoes up the Mississippi. While in the northern country Hennepin discovered the falls in the Mississippi where Minneapolis now stands. He named them the Falls of St. Anthony, after his patron saint, St. Anthony of Padua.

Soon Hennepin was released by the Sioux, and returned to Quebec and thence to France. There he published his 'Description of Louisiana' on which his fame rightfully rests. Unfortunately, some years later, after the death of La Salle, Hennepin published another book in which he claimed that he also went *down* the Mississippi and discovered its mouth before La Salle made his memorable journey. This falsehood has greatly dimmed the glory which rightfully belongs to Father Hennepin, because for many years people were afraid to trust his first accounts of what he really had done.

HENRY, HOLY ROMAN EMPERORS. Seven rulers of this name are counted in that union of Germany and Italy which is called the Holy Roman Empire (*see* Holy Roman Empire). HENRY I, "the Fowler," was king of Germany from 919 to 936, but never concerned himself with Italy and his power even in Germany was weak outside of Saxony. HENRY II, called "the Saint" (reigned 1002–1024), was the last of the Saxon house; he made three expeditions into Italy and was an earnest supporter of church reform. HENRY III was a member of the Salian line, and in his reign (1039–1056) the kingdom of Burgundy was added to the empire.

HENRY IV (reigned 1056–1106) succeeded his father, Henry III, when he was less than six years old. He grew up wilful and headstrong amid bitter contests over the regency. A few years after he took power into his own hands the storm of the Investiture conflict broke and lasted far into the reign of his son. The question was whether the Pope or Emperor—church or state—should control the appointment of bishops and other high clergy, who were not only high officers of the church but great feudal princes exercising power in the state as well.

THE EMPEROR HUMBLES HIMSELF BEFORE THE POPE

When Emperor Henry IV defied Pope Gregory VII, his people revolted, and he was forced to journey across the Alps in the dead of winter to obtain the Pope's pardon. Here we see him at Canossa, after he had been kept waiting without food for three days, ascending the steps barefooted and in penitent's robe to kneel at Gregory's feet.

In 1077 revolts in Germany forced Henry IV to cross the Alps into Italy in the dead of winter, and abase himself before the Pope, Gregory VII, at Canossa. Only after standing three days in the courtyard, fasting and barefoot, was he admitted and the Pope's excommunication raised, on hard conditions. It was the most brilliant victory that the papacy ever won over the temporal power. It proved, however, to be only an incident in a long struggle which outlasted both Henry and Gregory. (*See* Gregory, Popes).

HENRY V (reigned 1106–1125) joined his father's enemies in 1104, and the elder Henry died in defeat at Liége, in what is now Belgium. The son, when once seated on the throne, became as staunch an upholder of the imperial claims as his father. In the Concordat of Worms (1122) the Investiture conflict was ended by a compromise, which guarded the just rights of both parties. Henry V died without children, and the throne then passed to the Hohenstaufen House.

HENRY VI (reigned 1190–1197) was the third of the Hohenstaufen line, the able son of the great Frederick Barbarossa and the father of Frederick II, "the wonder of the world." (*See* Frederick, Emperors). The chief event of his short reign was his acquisition by marriage of the Norman kingdoms of Sicily and Naples.

HENRY VII (reigned 1308–1313) was the last emperor who sought to obtain the claims and traditions of the medieval Empire. He died in Italy, frustrated in his attempts to restore any effective union of Italy and Germany.

HENRY, KINGS OF ENGLAND. Eight Henrys have sat on the English throne since this name was first introduced into the royal line in the person of Henry I, youngest son of the Norman conqueror; and all except two of these royal Harries (Henry III and Henry VI) were among the ablest sovereigns of that island kingdom. But the disfavor created by the crimes and oppressions of the last of the series—the tyrannical Henry VIII, father of the great Elizabeth—was so great that no English sovereign since his time has borne this formerly popular name.

HENRY I, who reigned 1100–1135, was called "Beauclerc" because, unlike most princes of that age, he was a "good scholar." He is credited with saying that "an unlettered king is only a crowned ass." During the 35 years of his reign England enjoyed peace and prosperity. The chronicler of those times wrote that he "was a good man and great was the awe of him; no man durst ill-treat another in his time."

At his accession Henry I issued a famous "Charter of Liberties" which became the basis of Magna Carta, the foundation of the liberties of the Anglo-Saxon world. He also favored the church in order to win its support against the pretensions of his elder brother Robert, who claimed the English throne in addition to the duchy of Normandy left him by their father. The English were conciliated by his marriage with Matilda, a descendant of the Anglo-Saxon kings. And the support of the common people was assured by his repression of the Norman nobles and by the justice he administered through the "King's Court." The "Lion of Justice," he was called.

One misfortune darkened Henry's later years. His only son was drowned when the *White Ship* sank in the English Channel, and, according to the story, the king "never smiled again." This accident left his daughter Matilda and his nephew Stephen contestants for the throne at his death (*see* Stephen, King of England).

Great Work of the First Plantagenet King

HENRY II, 1154–1189, was the son of Matilda, and the grandson of Henry I. His father was Geoffrey of Anjou, called "Plantagenet" from his habit of wearing a sprig of the broom plant (*planta genista*) in his cap; so with Henry II, in 1154, the first Plantagenet king ascended the English throne. Two years before he became king, as a lad of 18, Henry had led an army from France to assert his mother's claim, and the wearied Stephen had agreed to a treaty by which Henry was recognized as his successor.

HENRY II
The First of the Plantagenet Kings

Henry II was the most powerful prince in Christendom. In addition to England and Normandy which he held by his mother's right, he inherited from his father, as French fiefs, the important counties of Anjou, Maine, and Touraine, and by his marriage with Eleanor of Aquitaine he acquired Poitou, Guienne, and Gascony, so that he held most of the British Isles and about one-half of France. Frequent wars with his suzerain the French king followed, in which his rebellious nobles took unsuccessful part against him.

Henry II re-established law and order after the anarchy of Stephen's reign. He improved the military service by permitting the barons to pay "scutage" or shield money in place of serving in the army; with this he hired soldiers who would fight whenever and wherever he wished—an important means of keeping in order the powerful nobles of the land. But his greatest work was the reform of the law courts. The Curia Regis was brought into every part of England by sending learned judges on circuit through the land to administer the "king's justice," so that gradually one system of law took the place of the many local customs that had been in use. He also established the "grand jury" by which accusations could be brought by a body of representatives of the community against evildoers who were so powerful that no single individual dared accuse them. To him also we owe the growth of the "petty" or "trial jury," especially in cases relating to land; this substituted the weighing of evidence and testimony by sworn men for the old superstitious trial by battle or by ordeal. Henry even attempted to bring churchmen who committed crimes under the king's courts, but the scandal caused by the murder of Archbishop Thomas Becket in the course of this quarrel forced him to give up this reform (*see* Becket, Thomas).

HENRY IV
Founder of the House of Lancaster

Henry's last years were embittered by the rebellion of his sons, aided by Philip Augustus of France and by their mother, the unscrupulous Eleanor. The king, old, sick, and discouraged, had to consent to the terms demanded of him. When he saw the name of John, his favorite son, among those of his enemies, he exclaimed, "Now let all things go as they will; I care no more for myself, nor for the world." Two days later he died muttering, "Shame, shame on a conquered king."

Henry III, 1216-1272, son of King John, was a religious man and a good husband and father, but he was a weak and incompetent ruler. Until he became of age officers trained under his grandfather, Henry II, directed affairs, and good order and prosperity prevailed. When Henry III took the administration into his own hands, he squandered the revenues of the kingdom on greedy relatives and favorites. The nobles seized upon his misgovernment as an excuse for rebellion in the Barons' Wars, under the leadership of the patriotic Simon de Montfort (*see* Montfort, Simon de). After Simon was defeated and slain in the battle of Evesham (1265), the people looked to the king's son, Edward I, for good government, and during the last seven years of Henry's reign the country was quiet and prosperous, the king being guided largely by the advice of his gifted son, Prince Edward.

The Lancastrian Henrys

Henry IV, 1399-1413, founder of the royal House of Lancaster, landed in England from unjust exile with only 60 followers. The 60 soon became 60,000, for all classes of people were tired of the mingled weakness and tyranny of Richard II, grandson and successor of Edward III, and he was now deposed and imprisoned. And Henry IV, claiming descent "by right line of blood from the good King Henry III," was seated on the throne by Parliament. But throughout his reign of 14 years his position was insecure and trying. The claim later asserted by the House of York was felt to be a better hereditary title to the throne than that of Lancaster. Scotland was restless, newly conquered Wales broke into open revolt, and the powerful family of the Percies, to whose aid Henry IV owed much in gaining the throne, took arms under the famous "Hotspur." So Henry perforce was obliged to keep on good terms with the church, and to permit the newly arisen Parliament to exercise powers in the government which became a notable precedent in later struggles between Crown and Parliament. Shakespeare represents him as speaking these words on his death bed to his son and successor, Henry V:

> Heaven knows, my son,
> By what by-paths, and indirect crook'd ways,
> I met this crown; and I myself know well,
> How troublesome it sat upon my head:
> To thee it shall descend with better quiet,
> Better opinion, better confirmation;
> For all the soil of the achievement goes
> With me into the earth. . . .

Henry V, 1413-1422—the former madcap "Prince Hal" of Falstaff's companionship in Shakespeare's scenes—proved the hero-king of England. As king he "put away childish things," and was sober, clearheaded, and vigorous, so that he acquired the reputation of being "the most virtuous and prudent of all the princes reigning in his time." He followed his father's advice to "busy giddy minds with foreign quarrels" by putting forth again the claim to the French throne, formerly raised by Edward III, thereby renewing the Hundred Years' War (*see* Hundred Years' War). By his brilliant victory at Agincourt (1415) he conquered all the northern half of France, and by a treaty five years later he married Princess Katherine of France, and it was agreed that he should become king of France also after the death of her father, the insane Charles VI. In the midst of his victories, Henry V died of camp fever, leaving as heir to his rights in both kingdoms his infant son Henry, nine months old.

Henry VI, 1422-1461, was one of the most unfortunate kings who ever sat on a throne. While he was still a baby his uncle, the Duke of Bedford, ruled for him, and for a time maintained and even extended the English conquests on the continent. Then the French were aroused by Joan of Arc, who raised the siege of Orleans and brought the young French king, Charles VII, to Reims to be crowned (*see* Joan of Arc).

Matters did not mend for the English when Henry VI grew to manhood. He was truthful, upright, and just, but he had neither the strength of mind nor of body to rule a kingdom, and for long periods he was insane like his French grandfather. War and business were never to his liking; he would rather have lived the life of a monk. So bit by bit the English lost the lands which they held in France, until only the city of Calais was left to them when the long Hundred Years' War ended, in 1453.

Meantime the misgovernment of Henry's ministers at home led to a rebellion under Jack Cade, in 1450, in which London was taken before the insurgents were overpowered and their leaders executed. Five years later began the bloody and merciless Wars of the Roses. In these Queen Margaret, Henry's French

KING HENRY'S PRAYER BEFORE THE BATTLE OF AGINCOURT

The bearded warrior in the foreground with his hands folded is Henry V. He has drawn up his small army to receive the blessings of the priests, before giving battle to the French. Men, horses, and the torn flag tell of the hard campaigns they have been through. A few hours after the scene depicted here, the English had gained one of the most brilliant victories in their history, and Henry had made himself master of northern France. This is a reproduction of a famous painting by Sir John Gilbert, which hangs in the art gallery of the Lord Mayor's mansion in London.

wife, was the real head of the Lancastrian party, and King Henry played only a feeble part. But in the course of the contest he lost his throne to the Yorkists, his young son Prince Edward was slain, and the king himself was finally murdered in the Tower of London, where he was imprisoned. (*See* Roses, Wars of the.)

The Founder of the Tudor Line

Henry VII, 1485-1509, who claimed descent from the Lancastrian House, gained the throne by overthrowing the last of the Yorkists. When the battered crown of the usurper Richard III was picked up on Bosworth Field and placed on the head of Henry Tudor, this seventh Henry, the Wars of the Roses ended, and with them the Middle Ages in England. He was the first modern king of that land. He united the houses of Lancaster and York by marrying Elizabeth of York, niece of Richard III. War had no place in the policy of this Tudor king, who was called the "Solomon of England" and was regarded as the craftiest and stingiest prince of his time. Abroad he secured his aims by treaties and by the marriage alliances of his children. At home he increased his power by forbidding the great nobles to maintain lawless bands of followers, and by compelling them to obey the laws by means of his famous Court of Star Chamber (*see* Star Chamber). He thus laid the basis of that powerful Tudor monarchy, as it came to his son Henry VIII, and the great Elizabeth.

Henry VII is also to be remembered because in his time the Renaissance (*see* Renaissance) was established in England. William Caxton had introduced printing into England shortly before this; and it was John Cabot, sailing by permission of Henry VII, who laid the foundation for England's claim to Newfoundland and the mainland of North America.

Henry VIII, 1509–1547, was educated in the New Learning, and—before the death of his elder brother Arthur made him heir to the throne—was intended for the archbishopric of Canterbury. He was a gay and handsome youth, well skilled in all manner of athletic games, though in later life he became coarse, fat, and ungainly. For nearly 40 years he ruled England with a strong hand and brought about one of the most far-reaching changes ever effected in the institutions of any kingdom. For motives of policy he was betrothed to his brother's girl widow, Catherine of Aragon. During the first 20 years of his reign he left the shaping of policies largely in the hands of his great counselor, Cardinal Wolsey, who sought to give England importance by acting as an arbiter between warring Spain and France. On one occasion Henry took part in France in the gorgeous display of the "Field of the Cloth of Gold," where he and the young French king, Francis I, met to wrestle, dance, watch tournaments, and talk of international relations and policies.

HENRY VIII
England's Royal Bluebeard

At the end of this period Henry professed doubts as to the power of the Pope to grant him the "dispensation" which the laws of the church had required in order that he might marry his brother's widow. Perhaps these doubts were strengthened by the fact that the only one of Queen Catherine's children to live was a sickly girl—the Princess Mary—and it was doubtful whether a woman could succeed to the English throne. Then, too, Henry had grown tired of Catherine and had fallen in love with a young lady of the court named Anne Boleyn.

When the Pope would not annul his marriage, Henry in furious anger turned against his faithful minister Wolsey, deprived him of his office of Chancellor, and had him arrested on a charge of treason (*see* Wolsey, Cardinal). He then obtained a divorce from Thomas Cranmer, whom he appointed Archbishop of Canterbury for the purpose, and it was soon announced that he had married Anne Boleyn. The Pope was thus defied. All ties that bound the English church to Rome were broken. Appeals to the Pope's Court were forbidden; all payments to Rome were stopped; and the Pope's authority in England was abolished. By an act of Parliament, Henry himself was declared "Supreme Head of the Church of England," and to deny this title was made an act of treason. Some changes were also made in the church services, and the Bible translated into English and printed copies placed in the churches. The monasteries throughout England were dissolved and their vast lands and goods turned over to the king, who in turn granted those estates to noblemen who would support his policies. In the northern part of the kingdom the people rose in rebellion in behalf of the monks, but their "Pilgrimage of Grace," as it was called, was put down with bloody cruelty.

Although Henry reformed the government of the church, he refused to allow any changes to be made in its doctrines. Before his divorce he had opposed the teachings of Luther in a book which had gained for him from the Pope the title "Defender of the Faith"—a title the kings of England still bear. And after the separation from Rome he persecuted with equal severity the Catholics who adhered to the government of Rome, and the Protestants who rejected its doctrines.

With equal bloodthirstiness he put to death every possible claimant to his throne. Among other victims whom he sent to the block were two of his wives, for he was married six times. You may perhaps have heard the old jingle:

King Henry the Eighth to
six wives was wedded.
One died, one survived,
Two divorced and two beheaded.

Anne Boleyn bore the king one child, the famous Elizabeth; then she lost his regard and was put to death. A few days later Henry married his third wife, Jane Seymour, who died in a little more than a year, after having given birth to the future Edward VI. A marriage was then contracted with a German princess, Anne of Cleves, whom the king had been led to believe to be very beautiful. When he saw her he discovered that he had been tricked; and he promptly divorced this wife and beheaded Thomas Cromwell, the minister who had arranged the marriage. His fifth wife, Catherine Howard, was sent to the block for misconduct. But the sixth one, tactful Catherine Parr, managed to survive this royal Bluebeard and lived to marry her fourth husband.

Henry, Kings of France. Four kings of France have borne the name of Henry, of whom the last was the greatest. **Henry** I, who ruled 1031–1060, was a contemporary of William the Conqueror, of England, and was defeated by that invincible warrior when he attempted to assert his authority over the duchy of Normandy. Under **Henry** II (1547–1559) began the religious persecution of the Huguenots, which laid the fuse for the religious wars after his death. He died in a tournament, when a splinter from a lance entered the eye-hole of his helmet and penetrated to his brain; in this, Protestants saw the hand of Providence. The utterly worthless **Henry** III (1547–1589), the last of the three weak sons of Henry II and Catherine de Medici, was for a brief period elective king of Poland before he succeeded to the throne of France. His death by an assassin's hand, in the course of the Huguenot wars, opened the succession to his Protestant rival, Henry of Navarre.

Henry IV, king of France and Navarre, who reigned from 1589 to 1610, was the last and greatest of the Henrys. He was king not only of France but also of the small independent kingdom of Navarre, on the northern slope of the Pyrenees. In 1569, when he was 16 years old, his mother, Jeanne d'Albret, the Huguenot queen of Navarre, placed him in the care of Admiral Coligny, the brave Huguenot leader (*see* Coligny, Gaspard de). From that time until his accession as king of France, Henry of Navarre was the recognized leader of the Huguenot party; but, for a short time after his marriage to the king's sister, Margaret of Valois, and the subsequent massacre of St. Bartholomew's Day, he seemed to renounce the Protestant faith in his tolerant easy-going way.

HENRY IV
"Now glory to the Lord of Hosts, from whom all glories are!
And glory to our Sovereign Liege, King Henry of Navarre!"

At the death of Henry III, in 1589, Henry of Navarre was the heir to the throne of France. But his right of succession was disputed by the powerful Catholic League, aided by the king of Spain, and he was not crowned until he had enforced his claim by arms and had become a member of the Catholic church. The victory was practically won at the battle of Ivry, in 1590, which Macaulay has rendered famous by his poem of that name, beginning—

> Now glory to the Lord of Hosts, from whom all glories are!
> And glory to our Sovereign Liege, King Henry of Navarre!

Henry IV also set about restoring the prosperity of the land. "My wish," he said, "is that every peasant in the kingdom should be able to have a chicken in the pot for his Sunday dinner." Agriculture and manufacture were encouraged by him, and roads repaired so that commerce might be benefited.

The improvement in the condition of the people, in which he was aided by his great minister the Duke of Sully, and the agreeable personality of Henry IV, the first of the Bourbon kings, combined to render him the most popular king France has ever had. He was struck down by the dagger of a religious assassin, as he was riding through the streets of Paris, leaving the throne to his young son, Louis XIII.

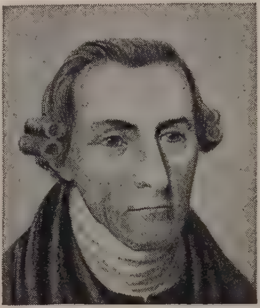
Although he conformed to the Catholic church, Henry IV did not forget the claims of his former religious associates. The Edict of Nantes, which he issued in 1598, gave the Huguenots equal political rights with Catholics; the right to reside freely anywhere in France; freedom of private worship in their own homes, and public worship in certain places (not including the king's court or within five leagues of Paris); and the government of La Rochelle and a few other strong places as "cities of refuge." This edict remained in force, with some modifications, for nearly a hundred years (*see* Louis, Kings of France).

HENRY, PATRICK (1736–1799). The stirring words of Patrick Henry, "Give me liberty, or give me death," furnish the keynote of that famous orator's public career. As an agitator and a champion of the common people he had no equal in his day.

Patrick Henry was born in east-central Virginia, of good Scottish stock, and received such education as the scanty opportunities of that vicinity permitted. But he was a venturesome and fun-loving youth, and gave up his studies at the age of 15 to enter business. Three times within the next seven years he failed—twice as storekeeper, and once as a farmer. Convinced that he had no ability in either of these fields, he next turned his attention to law. Here he found a congenial pursuit, for he was a born talker. After a few weeks of study, he was admitted to the bar. He succeeded immediately as a pleader before frontier juries, and his accounts show that during the first three years of practice he collected fees in 1,185 cases.

In 1763 Patrick Henry supported the people against the established church in a case known as the "Parson's Cause." During the trial of the case he declared in an impassioned speech that a king by vetoing salutary acts of a colonial legislature "degenerates into a tyrant and forfeits all right to his subjects' obedience." This declaration brought him the love of the colonists, and a seat in the Virginia House of Burgesses, just at the time of the passage of the Stamp Act in 1765.

When the older members of that House hesitated, not knowing what course to take in regard to the Stamp Act, Patrick Henry brought in a series of resolutions, declaring that the English Parliament had no right to tax the American colonies. In the debate which followed, Henry exclaimed with terrifying boldness: "Caesar had his Brutus; Charles the First, his Cromwell; and George the Third . . . " Here he was interrupted by loud cries of "Treason! Treason!" from members of the House. Pausing for a moment Henry coolly added: "And George the Third may profit by their example. If *this* be treason make the most of it!" This fiery speech secured the adoption of the resolutions. By his fearlessness and his eloquence Patrick Henry had become the spokesman for the colonial cause in the southern colonies, as James Otis and Samuel Adams were in New England.


PATRICK HENRY
The Orator of the Revolution

In 1774 Henry was sent by Virginia as a member of the first Continental Congress, where he declared in ringing tones, "I am not a Virginian, but an *American!*" Next year at the second revolutionary "convention" called in Virginia, he made his most frequently quoted speech, in urging the colony to arm her militia:

"Gentlemen may cry peace! peace!" he said, "but there *is* no peace! The war is actually begun! The next gale that sweeps from the North will bring to our ears the clash of resounding arms! Our brethren are already in the field. Is life so dear, or peace so sweet as to be purchased at the price of chains and slavery? Forbid it, Almighty God! I know not what course others may take; but as for me, give me liberty, or give me death."

No one contributed more to arouse the people of Virginia, and a few months later Henry was appointed commander-in-chief of the Virginia troops. He soon quarreled, however, with the Committee of Public Safety, which acted as the governing body of the colony, and resigned his commission. This was perhaps fortunate, for Henry had greater talents as an agitator than as a military leader.

Patrick Henry also aided in drawing up Virginia's state constitution in 1776, and was elected first governor of the state. He filled this post moderately well and was three times reëlected. It was with a commission from Governor Henry that George Rogers Clark set out to conquer the territory northwest of the Ohio from the British.

Henry Opposes the Constitution

In the Virginia convention of 1788, called to ratify the new constitution of the United States, Patrick Henry bitterly opposed the adoption of the new form of government, which he believed was dangerous to the liberties of the country. He objected to it because it contained no "bill of rights," because it infringed too much on the rights of the States, and because (as he said) it would prove "one great consolidated national government of the people of all the States," instead of a mere confederation. And he asked, "Who authorized them (the framers) to speak the language, *we the people,* instead of, *we the States?*" Fortunately Henry's advice to reject the Constitution was overruled by the wiser counsels of Washington and Madison; but as a result of such opposition the first ten amendments to the Constitution were adopted, known as the "bill of rights."

Henry refused all offices under the new government. In 1799, however, he consented to serve again in the Virginia legislative assembly, but he died before he could take his seat. Long before that event he had become reconciled to the Federal Constitution whose adoption he had so bitterly opposed.

HENRY THE NAVIGATOR (1394–1460). "It is said, Sire," remonstrated the sailor, "that he who crosses the Sea of Darkness will be changed into a black—God's vengeance on his insolent prying; that he will reach the Devil's ocean that boils day and night with fiery heat; and that he will find its hellish coasts fringed with sea monsters, serpent rocks, water-unicorns, and other fearsome creatures!"

Prince Henry of Portugal, that munificent patron of voyagers and explorers and one of the heroes of modern discovery, laughed at his captain's fears. "The sea is as easy to sail in as the waters at home," he told him, "and the land very rich and pleasant. Heed not these idle tales; for, by God's help, fame and profit must come from your voyage, if you will but persevere."

Prince Henry did more than any other single person to make the 15th, 16th, and 17th centuries the great Age of Discovery. For 50 years he kept encouraging his countrymen to sail down the west coast of Africa, so that before his death they had pierced through into the unknown South for nearly 2,000 miles.

A Man of Amazing Energy

Henry the Navigator, as he is called in honor of the discoveries he inspired, was the fifth son of John I, king of Portugal, and of Philippa, daughter of the English John of Gaunt. He early distinguished himself at the conquest of Ceuta, the "African Gibraltar," in 1415. Soon afterwards he moved to Sagres, a town close to Cape St. Vincent, where he resided for a great part of his life. While warring against the Moors of Africa, he became greatly interested in this mighty continent, and longed for a better knowledge of the western ocean and the discovery of unknown regions. He founded an observatory and also a school where young men could learn navigation. Then he began sending out expeditions. One by one the rich islands of the Azores, Madeira, the Canaries, and Cape Verde were discovered, and the African coast was explored as far as Sierra Leone. "Explore, trade, convert!" said Prince Henry to his men. All this they did, and—less happily—began trading in captured African slaves.

Prince Henry died before the full results of his work were seen. These results, which made people at last realize that the oceans were not great lakes in a world of land, were credited to others. But the real master of the bold sailors who discovered America, rounded the Cape of Good Hope, reached India, and finally encircled the globe was Henry the Navigator.

HEPAT'ICA. Sometimes while wandering among the woods and hills in early spring you come upon little clumps of delicately tinted flowers in fuzzy coats, which raise their lovely heads through the old dead forest leaves, like the dainty faces of a bevy of patrician ladies muffled in their furs. These are the hepaticas. What charm they have, these little blossoms of blue, lavender, pink, or white—no two clusters alike in shade or size! Even the gift of fragrance is not entirely denied them, but, in the language of John Burroughs, "seems as capricious as the gift of genius in families." Sheltered from the frost by their rusty evergreen leaves, and warmed by the late winter sunshine, they bloom even under the snow itself, on shaded hillside or in woodland dell. And then, after the blossoms, come the new green leaves —rounded, leathery, and glossy green, sometimes mottled with purple—to replace the last year's weather-worn foliage. There are many spring blossoms to follow, but none is fairer than this brave little wilding of the Crowfoot family that heralds the spring from Nova Scotia to Florida and westward to Manitoba, Iowa, and Missouri.

Scientific name, *Hepatica triloba*. The flowers, growing singly on slender stems, are about three-quarters of an inch broad and have 6 to 12 petal-like sepals enclosed in three fuzzy reddish-green leaflets. In the center are numerous pistils and anther-bearing stamens. There is no corolla, the sepals taking the place of ordinary petals. The slender, hairy stems, springing from the roots, are from 4 to 6 inches tall, and each bears a flower or leaf. The 3-lobed evergreen leaves are thick and liver-shaped, whence the name "hepatica" (from the Greek, meaning "liver").

HEPHAESTUS (*hē-fĕs'tŭs*). The lame god Hephaestus (Roman Vulcanus), the son of Zeus and Hera, was the god of fire and the forge. He was lame from birth, according to some stories; but others assert that he was crippled by being hurled down to earth by Zeus, falling on the island of Lemnos, where he built a palace, with a workshop and anvil. He also had a beautiful palace in Olympus, or, according to others, under Mount Aetna, on the island of Sicily. Here with the help of the Cyclops, the one-eyed giants, he made the thunderbolts of Zeus, the armor of Achilles, and the weapons of Hercules. He was also aided by handmaidens whom he had made of gold and endowed with life. All the palaces of Olympus were built by him. In the Homeric poems the kind hearted but limping god is represented as a comic figure whose deformity provokes "inextinguishable laughter" in the other gods. He was the patron deity of the metal-workers.

HERA (*hē'rȧ*). By the side of Zeus on Mount Olympus, as the Greeks believed, reigned his stately wife Hera (called by the Romans Juno), queen of the gods. Their life was not always one of harmony, however, for Hera was quick to anger and Zeus frequently gave cause for jealousy. Hera was the goddess of womanhood, of marriage, and of maternity. The peacock, the cuckoo, and the pomegranate were sacred to her. She was usually represented as a beautiful majestic woman of mature age, with large wide-open eyes and grave expression inspiring reverence. Homer speaks of her as the "white-armed goddess" and the "ox-eyed queen." The most famous statue of Hera was the one by Polyclitus in the temple at Argos. This was a colossal image, in ivory and gold, representing the goddess seated on her throne, wearing a crown and bearing in one hand a pomegranate and in the other a scepter with a cuckoo at the top.

HERALDRY. In the Middle Ages, when knights wore armor that completely covered their heads and bodies, there grew up the custom of emblazoning devices on shields and surcoats so that the wearers could be distinguished. By slow degrees an elaborate science of heraldry developed. Strict rules were laid down regulating the assumption and design of armorial bearings, and colleges of heralds were founded to enforce observance of the rules. Most of the terms used in heraldry are French, because that language prevailed while the science was growing up.

Several coats of arms are often arranged or "marshalled" on the same shield or "escutcheon" to show descent, marriage, alliance, etc. To enable this to be done the shield is divided into halves by a single line extending across it vertically, diagonally, or horizontally; or it is divided into "quarters" by a cross-shaped arrangement of lines, and these quarters may be further subdivided. The colors or "tinctures" are called *or* (gold), *argent* (silver), *gules* (red), *azure* (blue), *sable* (black), *vert* (green), and *purpure* (purple).

The "charges" or devices are of infinite variety. Some are wide bands, variously named according to the direction in which they cross the shield. Thus the "pale" extends from top to bottom, the "fess" is a horizontal band in the middle, and the "bend" crosses diagonally from the upper left-hand corner (*dexter chief*) to the lower right-hand corner (*sinister base*). The "bend sinister," crossing from upper right to lower left, is popularly but erroneously considered a mark of illegitimacy. Other common charges are simple geometrical designs, and others are conventionalized representations of animals, flowers, trees, leaves, etc. The animal most frequently used is the lion, which may have several positions: *rampant* (erect on the hind legs), *passant* (walking), *couchant* (lying with the head raised), *dormant* (asleep), etc.

Heraldry gets its name from the heralds of the Middle Ages, who were the official representatives of kings and lords. The heralds were also the court chroniclers, and it was their duty to keep track of family relationships and of the intricate etiquette governing coats-of-arms.

Some ADVENTURES of the Great HERCULES

The Many Valiant Exploits of the Mightiest of Greek Heroes—How He Chose Virtue for His Guide, and Performed Deeds of Superhuman Daring

HERCULES (*hĕr'kiu-lēz*). The most celebrated of all the Greek heroes was the mighty and great-hearted Hercules (or Heracles as the Greeks called him), the son of the great god Zeus and the mortal Alcmene. The goddess Hera (Juno) was hostile to Hercules from his birth, and sent two serpents to destroy him in his cradle, but the infant strangled them with his hands. He was trained in manly accomplishments by the famous centaur Chiron and other heroes of renown.

When Hercules reached young manhood, so the story goes, two beautiful maidens appeared to him, Arete (virtue) and Kakia (vice). Kakia offered him a life of ease, pleasure, and riches, if he would follow her; Arete said that if he chose her, he must live a life of poverty and hardship, and spend his days in continual struggle against evil. Hercules chose to be guided by Arete in the hard path she pointed out to him.

In early art Hercules was always shown bearded, but later sometimes youthful and beardless.

In a fit of frenzy sent by Hera he slew his own children, and to atone he was forced to serve his cousin King Eurystheus, who compelled him to perform the great tasks known as the "twelve labors."

The first labor was the slaying of the Nemean lion, a monstrous beast that terrified the country of Nemea. Hercules strangled the animal with his own hands; and ever afterwards wore the lion's skin. Next he slew the Hydra, a terrible nine-headed water serpent. As soon as he crushed one of the monster's heads with his club, two more grew in its place, but finally with the help of a friend, who seared each neck with a blazing branch, Hercules succeeded in killing the Hydra. He then dipped his arrows in the poison of the serpent.

His third task was to capture and bring alive to Eurystheus the Cerynean stag, an animal with golden horns and brazen hoofs, so fleet of foot that it scarcely touched the ground. The capture of the wild Erymanthian boar was the fourth labor. A greater task was the fifth, the cleansing of the Augean stables. Augeas, king of Elis, had a herd of 3,000 oxen, whose stalls had not been cleansed for 30 years. By turning the rivers Alpheus and Peneus through the stables, Hercules finished the work in a single day.

As the sixth and seventh labors, he killed with his poisoned arrows the Stymphalian birds, which fed on human flesh, and captured the Cretan bull. This bull had been sent by Poseidon (Neptune) for Minos, king of Crete, to sacrifice. But Minos was so pleased with the beauty of the animal that he kept it for his own; whereupon Poseidon drove the bull mad and it caused great damage. Next came the capture of the horses of Diomedes, the Thracian king. These were wild mares to whom Diomedes fed the flesh of all strangers. Hercules killed Diomedes and threw his body to the horses, before bringing them to Eurystheus.

Hercules was then dispatched to obtain the beautiful girdle of Hippolyta, queen of the Amazons. Single-handed, the hero defeated the warrior-women, killed the queen, and escaped with the girdle. The tenth labor was the capture of the oxen of Geryon, a monster with three bodies, who dwelt on the fabulous island of Erythia, beyond the straits of Gibraltar. On his journey the hero erected the famous rocks on either side of the strait, known as the "Pillars of Hercules."

The eleventh exploit was to obtain the golden apples of the Hesperides, which Gaea, or Mother Earth, had presented to the goddess Hera as a wedding gift. Hercules succeeded through the help of the Titan Atlas, father of the Hesperides, the four sister-nymphs who guarded the apples with the help of a sleepless dragon. Atlas, whose task it was to support the weight of the heavens on his shoulders, went to get the apples, while Hercules relieved him of his burden. While engaged in this labor, the hero encountered some other strange adventures, for on the way he met the tiny race of men called Pygmies and slew the giant Antaeus, son of Poseidon and Gaea, who compelled all strangers coming into his country to wrestle with him, on condition that if he conquered they would suffer death.

The last labor was bringing Cerberus up from the lower world. Braving the dread regions of Hades, he captured this many-headed dog, who guarded the entrance, and brought him before Eurystheus, who was so terrified that Hercules had to take back the monster to the realm of the dead.

Having finished his appointed tasks, Hercules was now freed from bondage. But these were not the only feats of strength and valor he performed. He gave way to violence at times, and once, in a fit of rage, slew his friend Iphitus, but for the most part his strength was used to relieve those who suffered pain or oppression. He delivered Prometheus, who for ages had been chained to Mount Caucasus. He brought back from the grave the noble Alcestis, who had given her life for her husband.

As the life of Hercules was a hard one, so also was the manner of his death. With his wife Dejanira he came to the bank of a river across which travelers were carried by the centaur Nessus. Hercules waded across the stream, while Nessus carried Dejanira. But when the centaur attempted to run away with Dejanira, Hercules shot him with one of the poisoned arrows. The dying Nessus called to Dejanira to take some of his blood and keep it as a charm to preserve the love of her husband. Before long, Dejanira, hearing that Hercules was in love with another maiden, sent him a robe which she had steeped in the blood of Nessus. No sooner had he put on the robe than poison spread through his body like fire and caused him such agony that fleeing to Mount Oeta he built a funeral pyre on which he threw himself to die. But as the flames consumed his body, Zeus caught up the immortal part and bore it to Mount Olympus, where, purged of mortal sin and sorrow, Hercules dwelt among the gods in eternal happiness.

Hercules has been a favorite character in literature and his heroic strength has inspired many beautiful works of art. The finest representation of the hero in sculpture is the so-called Farnese Hercules, now in the Naples Museum. This is a copy of an earlier work by the ancient sculptor Lysippus.

LIFE'S LAWS *of* INHERITANCE, *from* PLANTS *to* MAN

The Amazing Laws Discovered by an Austrian Monk, and How They Work—The Mysterious Chromatin that Carries All Heredity, One Ounce Enough for Millions of Offspring—How "Environment" Modifies Heredity

HEREDITY. The saying, "Like begets like,"—each kind of living thing "after its own kind"—expresses essentially the general fact of heredity, the universal law among all kinds of living things, both animals and plants. That it is so is a matter of observation in thousands of times and places, by anyone with sharp eyes, keen wits, and a mind open to the amazing things found in all of the common forms of life. An acorn grows into the giant oak, and not into the peach tree; and a hen's egg hatches into a chick with its many peculiarities, and not into a duckling.

But it is the outside or superficial things that most of us see, and we are apt to forget the vast multitude of more deep-seated resemblances between parent and offspring, many of them on the inside of an animal like man. The parents are tall, have dark hair, and dark eyes; the child will likely be tall, have dark hair, and dark eyes. But think a moment of the deeper things. The parents have three-jointed fingers and toes, eyelids, valves in the heart, many muscles and bones in nice order, many nerves always supplying the same parts of the body—and a thousand and one other things. So the child gets all these in proper form from his parents—always a miracle, and almost always unthought of! It is only when the child is not quite normal that people are apt to think of the unusual thing, when all the while the usual thing is the really more wonderful. How amazingly delicate and minute inheritance is may be observed by anyone among almost any kind of pure-bred domestic animals or plants, or almost any kind of animals or plants in Nature. And yet it remains true that we should really say that "like begets *almost* like"; for the likeness of parent to offspring is never complete.

The resemblance of child to parents is not limited to the structures of the body. The parent is keen, aggressive, resourceful, has a good memory—a thousand and one other things that make for "personality." So the child gets an amazing lot of things from its parentage. In many cases, of course, it is matter of common observation that the resemblance has come from the grandparents, or even more remote ancestors. In such cases, naturally, the traits have lain dormant in one or more generations. Francis Galton, the great English student of many human phenomena, stated this fact in the general law that children resemble their parents about half; grandparents about a quarter; great-grandparents about an eighth, etc. In recent years the tendency has been to place the proportion derived from the parents at a somewhat higher figure.

Let us now examine into the why and wherefore of heredity. It is evident, of course, that any new animal or plant is the product of its two parents, whom it resembles in ways so manifold and so intimate. It must further be clear that the two cells that unite to form the new animal or plant are alone the bearers of the heredity. When the very tiny pollen cell of a plant drops upon a flower, and grows down and unites with the tiny egg in the flower, there is started a new life—let us say of a bean plant. But the same is true for any kind of common animal or plant. It is always the union of an egg cell, and a very small cell from the male animal or plant, that starts the new life. Further, the biologist looks upon the granular material of the nucleus of the two cells as the carrier of heredity from parent to offspring, and this material he calls the *chromatin*. It is about the most wonderful and mysterious kind of material in the world. The most amazing thing about it is the unbelievably small amount of it that can carry all of the things from parent to offspring.

Let us glance for a moment at the four figures in the picture on page 1643. The large white segment in each section of the picture is a portion of the egg cell, much magnified, for the egg of most animals and plants is very small and requires the microscope for examination. Let us suppose it is the egg of a star-fish or of an angleworm, both of which eggs are invisible to the unaided eye. Inside the egg, which is here represented as transparent, you see two round objects containing dark threads and black dots. The round object on the right of the first section is the "pronucleus" of the egg, the dark threads are the female "chromatin," and the black dot is the female "centrosome." The round object on the left is the "pronucleus" brought into the egg by the male cell. It contains male "chromatin" and a male "centrosome." Now, it is most important to see that the two circles—the two nuclei from the two parents—are of the same size, and the amount of matter in the chromatin threads the same, for that is the reason an animal or plant may resemble its two parents equally.

In the succeeding figures the two bodies are approaching nearer and nearer, till in the fourth they have united and the rods are ready to divide in the formation of the two first cells.

Heredity Hidden in the Multiplying Cells

Look at this picture carefully, for it contains all that is to grow and develop into a new animal, the most wonderful process that takes place in animal or plant life. Now this fertilized egg cell is to divide into two; these each into two; and so on—many, many times—till the body of the new animal or plant is composed of its millions of cells of many kinds. Further, into each of the cells has gone some of the wonderful chromatin, half from each parent. And such a very tiny bit of it in each of the fertilized eggs that is to give rise to the new animal or plant! An ounce of it for any kind of animal or plant would carry the heredity for millions of new offspring.

What a miracle! What wonder that the student of Nature is all enthusiasm about his studies! He sees every day enough wonders and mysteries to stir his imagination for a lifetime. Think of the coming into being of a chick! We all know that, when heat and other favoring conditions have been supplied, the egg has changed into a pulsating living thing, with all its wonderful systems that make it a perfect animal, able to live its own life. And so it is for all of the many forms of life about us. And yet most of us pass through life, not seeing and not contemplating some of the most wonderful things the world contains—things about us every day.

Now let us go a little further. It must be clear to all, of course, that law and order are universal in Nature, and so there must be "laws" of heredity—laws that govern the inheritance of children from parents. It must be confessed that most of the laws of heredity remain to be discovered; yet much is known, discovered almost wholly in very recent years, and scientists believe much more will be known shortly. But such studies are among the most difficult in all the realms of science, and it may be many years before all has been made clear.

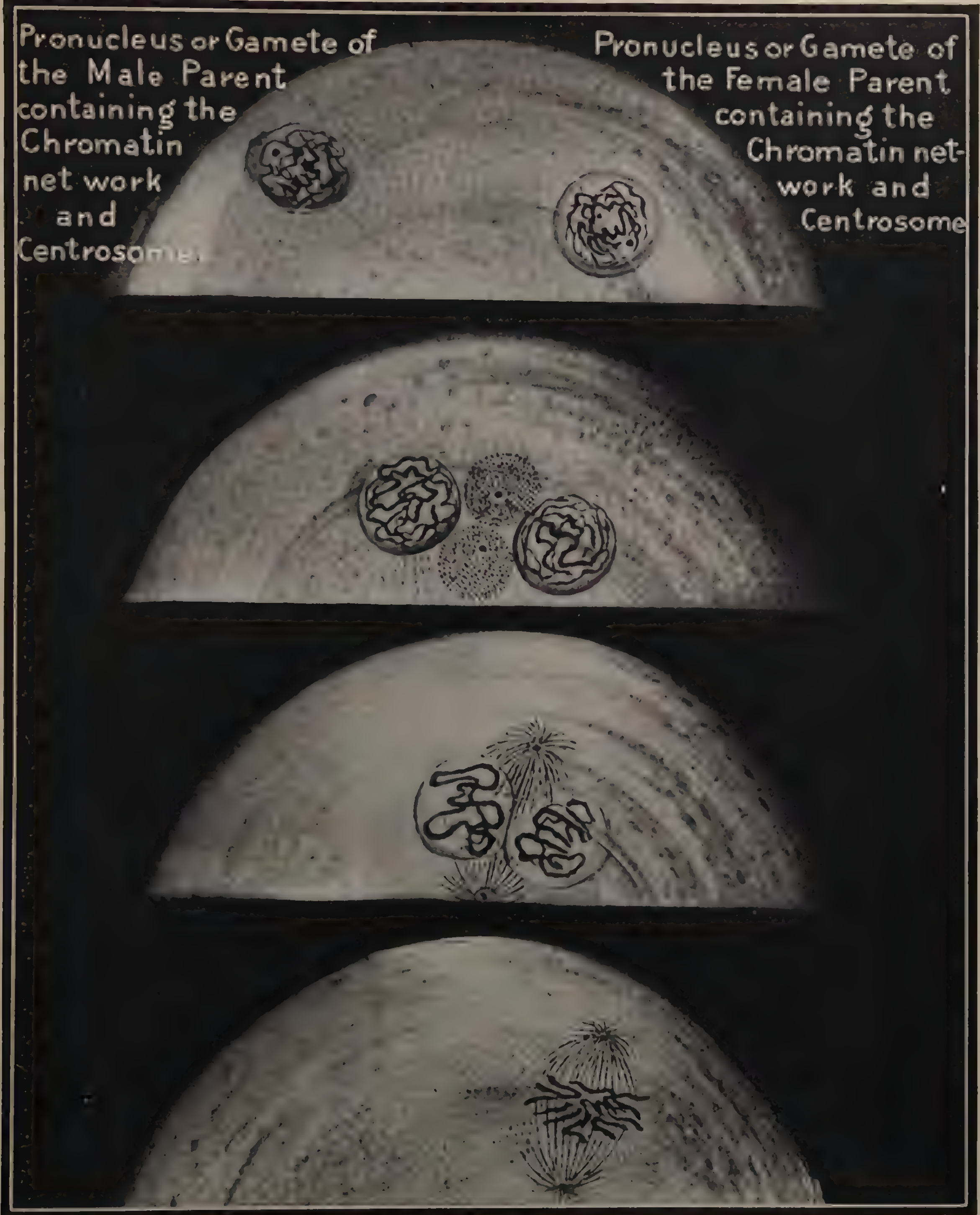
The outstanding worker in studies in heredity was an Austrian monk, Gregor Mendel (1822–1884), who published his discoveries in 1866, although the importance of his work was not recognized till 1900. He worked especially with peas, and the amazing thing is that his laws have been found to apply to many things, in many kinds of animals and plants. Think of it, the same *laws* for inheritance of many things in an animal, such as a guinea-pig, as for a plant like a pea! Let us illustrate by guinea-pigs. If the two parents be from pure strains, *black* and *white*, the children will be, not *gray* as might be expected, but *all black* in the first generation—all *apparently* pure black! But in the next generation there comes out one-fourth of the children pure *white* again, one-fourth pure *black*, and a half apparently pure black, but really *mixed* again. The pure whites and blacks will breed true, but the mixed ones will yield children of which a quarter are pure white, another quarter pure black, and half mixed. And so on, indefinitely. You see, in the apparently black there is hidden the white, to come out pure again in a quarter of the children of the next generation. In this case, where the black temporarily hides the white, the black is said to be "dominant" over the white. In some cases—"four-o'clocks" among plants, for instance—the children will be half-way between the two parents, and crosses of *reds* and *whites* will yield *pink* flowers in the first generation. But in the next there emerge a quarter pure red, another quarter pure white, and half pink. The whites are pure, so are the reds; but the pinks are mixed, and will behave exactly as in the color of the guinea-pigs—only one color is not "dominant" in this case.

Only a very few of the many illustrations of Mendel's law can be cited, and it must be remembered all the while that it is a matter of experiment in all cases to find out whether for any feature of any animal or plant it will follow Mendel's law. The following are among the most interesting: In rabbits and guinea-pigs, black is dominant over white, and short hair is dominant over long hair. Among cattle, hornless character of the "muley" is dominant over horned, short legs over long legs. In horses, bay is dominant over black or chestnut, and gray over all other colors, and pacing over trotting. In pigs, pure white is dominant over color, and black over red. In dogs, gray is dominant over black, and any pure color over mixed colors, like black-and-tan. These are but a few of the illustrations for a few animals; hundreds of others might be cited. It should be said, too, that some of the laws that have been discovered are much too intricate to give here. But enough is known to show that much advantage may be derived in future by applying the *laws of heredity* in improving many of man's domestic animals and plants.

Mendel's Law Applied to Man

What do we know of the laws of heredity as applied to *man?* Things we inherit fall under several types, and the following is the classification given by Professor Castle. In matters of stature, size of body, skin-color, shape of head and its features, children are apt to be intermediate between father and

HOW THE OLD LIFE PASSES INTO THE NEW


Pronucleus or Gamete of the Male Parent containing the Chromatin net work and Centrosome.
Pronucleus or Gamete of the Female Parent containing the Chromatin net-work and Centrosome

This picture represents the astonishing process by which the first complete cell of a new plant or animal life is produced. At the top we see a segment of the egg, with the female "pronucleus" at the right. The male "pronucleus" at the left has just made its way into the egg and is approaching the female. Notice the black dot in each "pronucleus"—those are the energy centers called "centrosomes." In the next section, the male and the female "pronuclei" have drawn close together and the two "centrosomes" have come out and arranged themselves in the space between the pronuclei. In the third section, the "centrosomes" have developed radiating threads, forcing the nuclei together. Finally, at the bottom, the male and female elements have merged into one group. At this instant a new life begins. The chromatin from each "pronucleus" has arranged itself into a central mass, which is composed of exactly equal parts of male and female substance. The new cell will now begin to grow as a separate life unit, inheriting its vital germs from both father and mother cells. How this new cell now proceeds to split up and form other new cells is explained in the picture on page 395, with the article on Biology.

mother. The following illustrate Mendel's law: Dark eyes dominate over light eyes; two-jointed fingers over normal three-jointed; brittle bones (of some people) over normal bones; normal eyes over color-blindness and over night-blindness; normal minds over feeble-minded. And so for other things. But it should be said that most human characteristics have not yet been shown to follow Mendel's law. The following are clearly hereditary, but how exact are the laws followed is not now certain: defective teeth and hair, hare-lip, tendency to twins, left-handedness, some forms of deafness. The following are subject to heredity, but to what extent and how they are inherited is not known: general mental ability, ability for art, music, mathematics, defective heart, some forms of epilepsy and insanity, longevity, and many other things. There is often a wrong impression that diseases are inherited. It is true that a *tendency* to some diseases may run in a family, just as in other families there is a natural immunity from some diseases. But a disease itself is not inherited. Tuberculosis is a disease due to tubercle germs. A child may be born with a constitutional tendency to the disease, but the germs come in after birth, with the food, water, or air.

The relative importance of heredity and environment in a human life is a question as old as the ages—a question never possible of a very accurate solution. Of course, it is clear to anyone that life is a very intricate fabric, in which the "warp" is supplied by heredity, and the "woof" by the things that come into one's life, mostly after birth. All these things that come in after birth make up what is usually called the "environment"—the food we eat, the air we breathe, the water we drink; still more important, the surroundings that make for moral and mental and spiritual welfare or disaster—the millions of things that come into all lives—these all together make up the "environment." And what of the relative importance of the multitude of things we bring into the world, and the infinitude of things the world gives us—even thrusts upon us?

How Much Do We Owe to Heredity?

On the one hand are those who maintain that a person is so strongly stamped by heredity—the things he brings into the world with him—that whatever he is and does in life is almost wholly the result of his inheritance. On the other side are those who maintain that the child at birth is so plastic that there are practically no limitations upon the possibilities; that, with proper surroundings and education, all for good is possible; with untoward surroundings, all for bad.

The truth certainly lies somewhere between the two extremes. Certainly the main qualities are stamped by heredity—stature, "stamina," tendency to good health, general ability, temperament—or the reverse of all these. But the outlet for any personality is most certainly dependent on its surroundings; and what a person becomes will much depend on his place and mode of life, his education, friends, all of the infinitude of things that make up his "environment." Just as there are sandy, sterile soils, and very fertile soils, and all grades between, so there are defective minds (the feeble-minded) and geniuses, and all grades between. And just as there are sterile soils for which cultivation will do nothing, while it will help much the other soils, so there are the helpless minds, for whom education and other forms of help avail little or nothing; while they avail much for the average mind, and most of all for the superior mind.

The weak person is always weak, whatever the surroundings; the person of average native ability and personality will be very much what his surroundings make him; while the strong person will be strong in any place or station in life. The particular form which his strength will take will depend on time and place. George Washington would have been great in any place and time, but he would not have been the "Father of his Country" had there been no Revolutionary War. Thomas Edison would have been strong anywhere and in any place; he became a great inventor because he lived in America at a time when the world of science and industry about him made his discoveries possible. So, we may conclude that the person of average native ability will still be average in almost any time and place, while a great career is a combination of great native ability, character, and personality, with great opportunity.

HER'MES. "A schemer subtle beyond all belief" was the Greek god Hermes, also called Mercurius (Mercury) by the Romans. He was the son of Zeus and Maia, daughter of Atlas. He began his career by escaping from his cradle, when a few hours old, and going out in search of adventures. Finding a tortoise, he took the shell and stretched cords across it, thus inventing the lyre. That same evening he stole the oxen of Apollo, god of the sun, hid them in a cave, and killed two of the oxen. When Apollo discovered the theft, Hermes so charmed him by playing on the lyre that he allowed the little rogue to go unpunished. Hermes gave his lyre to Apollo and received in return a magic wand, called the *caduceus*, which bestowed wealth and prosperity and turned everything it touched into gold.

Hermes was made the messenger of the gods, and in this capacity one of his many duties was to conduct the shades of the dead to the lower world. Among men he became the patron of merchants, the god of eloquence, of good fortune, of prudence and cunning, of fraud and theft. He was also regarded as the god of the roads and the protector of travelers. Pillars with his image at the top were erected as guideposts.

Hermes was represented most commonly as a slender youth, wearing a broad-brimmed hat adorned with two small wings, and carrying the caduceus in his hand. On his sandals were wings that bore him over land and sea with the swiftness of the wind. Of the statues that have come down to us from antiquity, the most famous is that by Praxiteles, representing Hermes carrying the infant Dionysus.

HERO AND LEANDER. The imperishable story of Hero, priestess of Aphrodite, and Leander, the stalwart lover who nightly swam the Hellespont to meet her, stands in literature as one of the supreme examples of ill-fated love. According to the story as told by various Greek and Roman poets (notably Musaeus in the 5th or 6th century A.D.) Hero used to place a lamp at the top of her lonely tower at Sestos each night to guide her lover in his struggle with the waves from Abydos on the other side of the strait. Venturing to make the passage one stormy night, he was drowned, and his body was washed up to the tower. Seeing the lifeless form of her lover, Hero plunged into the water that she might join him in death. The English poet Byron, who himself accomplished the difficult feat of swimming the Hellespont, refers to the tale in those well-known lines:

> The winds are high on Helle's wave,
> As on that night of stormy water
> When Love, who sent, forgot to save
> The young, the beautiful, the brave,
> The lonely hope of Sestos' daughter.

HEROD. The family name of several rulers in Palestine, of whom Herod the Great, king of Judaea from 37 B.C. to 4 B.C., was the most conspicuous. Scholars in general hold that Jesus of Nazareth was born towards the end of this reign. Herod Antipas, son of Herod the Great and tetrarch (tributary prince) of Galilee from 4 B.C. to 39 A.D., is the Herod most frequently mentioned in the New Testament; it was to him that Jesus was sent by Pontius Pilate.

Herodias, the granddaughter of Herod the Great and wife of Herod Antipas, instigated her daughter Salome (by her first husband) to ask of Antipas, whom she charmed by her dancing, the head of John the Baptist on a charger (a large flat plate), and this was granted her. John had angered Herodias by denouncing Herod Antipas for casting aside his first wife for her. Several operas have been based on this story, which is also a favorite subject in painting.

HEROD'OTUS (about 484–425 B.C.). The Father of History, as Herodotus is called, was born at Halicarnassus, a Greek colony on the shores of Asia Minor. He early devoted himself to a literary life and traveled extensively, visiting the shores of the Hellespont and the Black Sea (Euxine), as well as Scythia, Syria, Palestine, Babylon, Egypt, and the northern part of Africa. He investigated both the customs and religion of the peoples and the history of the countries through which he passed. He made use of the material which he gathered in his great work—the first specifically historical work ever written. The special purpose of Herodotus' work, which consists of nine books, is to give an account of the conflict between the Greeks and the Persians, whose history and enmity Herodotus traces back to mythical times. Incidentally it is a treasure-store for the early history of all the lands about the Eastern Mediterranean. Much of this early history, as narrated by Herodotus in his fascinating volumes, has been modified by the excavations and other researches of recent times; but considering the difficulties under which Herodotus collected his information, he is amazingly accurate.

HERONS. A family of long-legged wading birds, which includes also the bitterns and the night-herons. There are about 100 species, of which 12 occur in North America. They range in size from the great blue heron, four feet high, to the little green heron, the most familiar species in the United States, which measures 18 inches. Among them is the lovely egret, whose long white plumes have brought it such a tragic fate. (*See* Storks, Herons, and Cranes.)

HERRING. Economically the herring is the most important of all the families of fishes, for in addition to the typical fish of the family, the herring proper, it includes the shad, alewife, sardine and other food fishes, and also the menhaden. The menhaden is a very oily fish found in great schools off the east coast of the United States and taken chiefly for bait, manure, and for its oil.

The common herring is of immense value as a food fish, being used extensively both fresh and smoked or salted. A favorite preparation is the partly smoked form of "bloaters." Great quantities of young herring are canned and sold as sardines. Herring are found in incredible numbers in the North Sea, the north Atlantic, and the seas north of Asia. They swim in closely packed schools often covering areas of from 6 to 20 square miles. In the United States the chief fisheries are off the coast of Maine. A species similar to the common herring is found on the Pacific coast of America. The true herring belongs to the genus *Clupea*.

HESSIAN FLY. Tiny though it is—about one-eighth of an inch long—this insect pest does more damage to the grain field than any other. Its *larvae* or young suck the sap out of the tender shoots of wheat, rye, and barley, and kill about 10 per cent of the entire wheat crop of the United States and Canada. This means a loss of from 60,000,000 to 100,000,000 bushels of wheat every year in the United States alone—enough to feed several great cities for a whole year.

The Hessian fly has long legs, long feathery antennae, or feelers, and oval, rather small gauzy wings. It belongs in the same family with the gall-gnats, wheat midges, etc. The eggs are laid in the sheaths of the leaves of the young plant, and the little flattened pale red maggots eat into a joint near the base of the stem just where the leaf fits onto the stalk. Before they grow into adult flies they pass through the pupal stage, in which they resemble, and are called, flaxseeds. The female lays from 100 to 150 eggs, which hatch in about five days. From two to five broods are raised each year. Since only those in the flaxseed stage live through the winter, the insect can be destroyed by burning the stubble.

The fly gets its name from the common belief that it was brought into America by the Hessian troops during the War of the Revolution. Scientific name, *Cecidomyia destructor*.

SLEEP *that* LASTS *All* WINTER LONG

While the Grip of Ice and Snow is on the Land, Many Animals Withdraw to Shelters beyond the Reach of Frost and Remain in Deathlike Slumber until Warm Weather Returns—How They Live on Their Stored-up Fat

HIBERNATION. In northern countries the great majority of insects, worms, etc., and of the marine life fixed between high and low tide range, die in winter, leaving larvae to revive their race in the succeeding spring. Fishes of brooks and shallow streams, and of the shallows near shore, retire to deeper water. Most birds flee southward to a milder climate. This leaves a large body of terrestrial animals of various classes which, so far as passing the winter is concerned, may be divided roughly into two classes—those able to obtain food during the snowy season, and those whose food supply is cut off by wintry conditions.

LITTLE DORMOUSE'S LONG REST

Just before it is time to "turn in" for the winter, the Dormice get as fat as butter. Then they curl up in winter beds, and spend most of their time dozing until spring.

For these latter the only alternative to death is hibernation—sleep in a sheltered place; and it is resorted to by all kinds of northern animals except birds and fishes. Earthworms burrow below the reach of frost. All manner of insects in their pupa stages lie inert within cocoons or earthen caskets. Frogs bury themselves deeply in the mud of the pond or in loose soil and rotting stumps. Serpents coil up in crevices of rocks or holes in the ground. And certain four-footed animals occupy deep burrows or warm nests, where many of them pass from the pseudo-death of sleep to the reality, and find their *hibernaculum* (sleeping-place) a grave.

UNDER THE WINTER BEDCLOTHES

Frogs cover themselves with mud in the winter, using it for bedclothes during their long sleep.

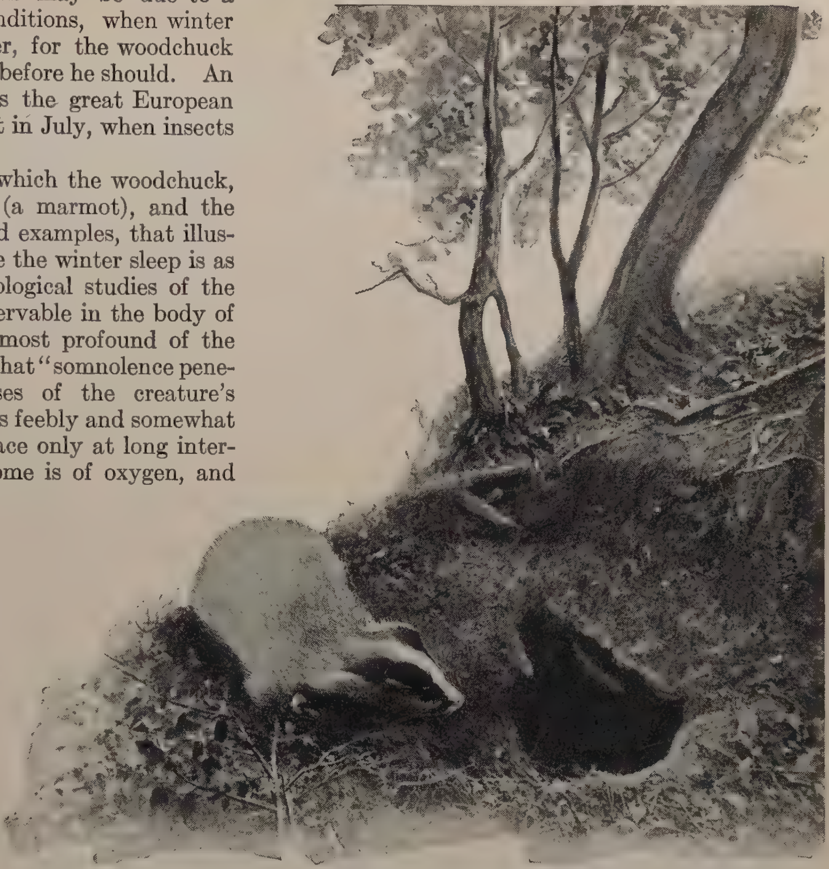
In almost all cases of hibernation the animal is one that is unable to get its accustomed food in winter, and has not learned to gather and save under cover a store of imperishable sustenance, such as nuts, seeds, dried fungi, and the like. Yet even the true hibernators prepare unconsciously for the ordeal by accumulating much fat, eating amply in the abundance of autumn, when nature's bounty is greatest, and storing up in their bodies the fuel and sustenance that shall gradually be absorbed for the nourishment of their systems during the long weeks of their dormancy.

What is the nature of this dormancy? We do not know. It seems not to be different from ordinary slumber except in its depth and prolonged duration, and hibernating animals differ much in the soundness of their sleep. Some, such as our bats, the chipmunk, and the red squirrel, are light sleepers, and often on mild days will wake up, come out, and move about indolently until the return of cold sends them back to bed. Bears are popularly regarded as special examples of hibernation, but they are among the most irregular. In very cold and snowy countries the females "den up" early and may be snowed under for weeks. They do not go into torpidity, but simply lie quietly, subsisting on their accumulated fat, the slow assimilation of which sustains their own life, and enables them to nurse the babies which are born during this winter retirement. It is thus the female ice bear passes the cold months, but the males are abroad during all the long, dark, polar night, even as far north as men have ever gone. In the case of other northern species the males also hibernate, each by itself, but are liable to come out from time to time.

From the central United States southward the bear need not hibernate at all. This is true of several other animals which must sink into a state of dormant vitality in sub-arctic regions, or on high mountain tops. Another irregularity, exceptional in relation to the food supply, is shown in the woodchuck, which retires to its snug underground bedroom much before the ordinary time of severe frost and snow, and while plenty of green herbage remains for its nibbling. This may be due to a habit inherited from former conditions, when winter came earlier and ended earlier, for the woodchuck often comes out in spring long before he should. An even more striking example is the great European bat, which begins its retirement in July, when insects are still plentiful.

It is the heavy sleepers, of which the woodchuck, the Rocky Mountain siffleur (a marmot), and the jumping mice (*Zapus*) are good examples, that illustrate the condition best. Here the winter sleep is as near death as possible. Histological studies of the minute structural changes observable in the body of a hibernating hedgehog—the most profound of the European hibernators—shows that "somnolence penetrates to the deepest recesses of the creature's constitution." The heart beats feebly and somewhat irregularly, breathing takes place only at long intervals and slowly, the only income is of oxygen, and the excretions are slight. The fat is slowly burnt away, the body cools down to a degree that in ordinary life would be fatal, and the senses fail to respond, except slightly to touch. Prof. Wesley Mills, who experimented largely with a dormant Canadian woodchuck, found that although you might roll it about like a football, apparently without the animal knowing it, gentle stroking of its fur produced uneasy movements of the skin as if it felt an unpleasant tickling. These sleepers may be awakened by warmth, but only to a stupid state, and close their eyes as soon as permitted.

MR. BADGER GOES TO BED



These trees must have on their autumn leaves, for it is in October that Mr. Badger goes into his burrow for the winter. When he comes out in the spring, he's in very good condition after his long fast, and not thin and weak like Mr. Bear.

DEEP DOWN BELOW THE REACH OF FROST

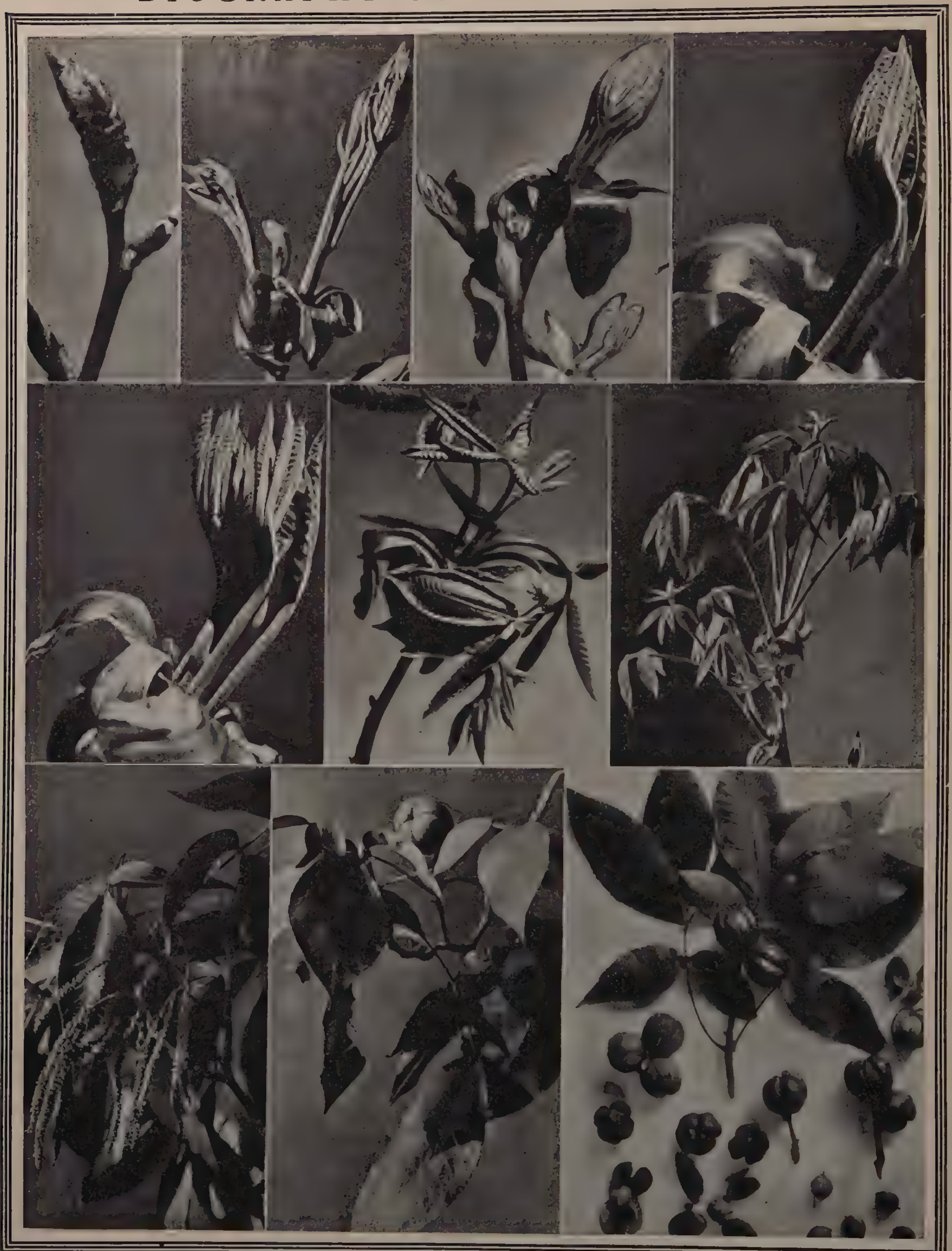
The Earthworm seems to know exactly how cold it is going to be, for he crawls down and coils up just below the frost line.

"The general import of hibernation is in most cases plain," remarks Prof. J. Arthur Thomson. "Life saves itself by ceasing to struggle, by retiring within its entrenchments. Death is baffled by a deep device, in which activity virtually ceases without life itself being surrendered."

HICKORY. In late autumn the wood-lots resound with the laughter and shouts of the schoolchildren who eagerly search among the dry leaves for the fallen hickory nuts, gathering an abundant store with which to while away the long winter evenings. The squirrels, too, find these nuts to their liking, and chatter noisily in the tree, fearful lest the children rob them of their winter's food supply.

The hickory is an American forest tree belonging to the walnut family. It is at its best in the southeastern United States. There are about ten species. The most popular is the small nut shagbark or shellbark hickory, native from southern Maine to Florida and westward to Texas. The tree is rather large, with a spreading top covered with narrow yellowish-green leaves. The nuts when freed from their husks

BIOGRAPHY OF A HICKORY NUT



In this life story of the Hickory Nut, we first see the bud, in the upper left-hand corner. In the next six pictures we observe the opening of the leaves. Then the tree blooms. Last of all come the nuts. The ones on the last picture are of the variety known as the "shagbark" or "shellbark" hickory, which delight children and squirrels in the autumn nut-gathering season, from southern Maine to Florida and westward to Texas. The nuts when green are surrounded by tough husks, which fall off, however, when the nuts ripen, leaving the hard whitish shell exposed.

have a hard whitish shell and are finely flavored. The big shellbark is similar to the small shellbark, but the nuts are larger and have thicker shells. The nuts of almost all species are edible, being sweet and tasty.

The "pig-nut," however, is an exception, as its thin-husked nuts are bitter and astringent. The "pecan" is a species of hickory; its nuts are so valued that the tree is widely cultivated in the southern part of the United States.

The wood of the hickory is of great value for articles requiring strength combined with lightness and elasticity. It is much used for ax, pick, and tool handles, for carriage shafts and thills, and similar purposes.

Scientific name of the small shellbark, *Hicoria ovata;* of the big shellbark, *Hicoria laciniosa.* Bark gray, loosely attached, breaking into long loose strips, which curve away from the tree. Leaves compound, alternate, odd-pinnate, narrow, dark yellowish-green. Fruit a whitish ovate nut inclosed in a thick four-valved hull, which (unlike the black walnut) falls away from the nut when ripe, exposing the hard tough shell.

HIEROGLYPH′ICS. From two Greek words meaning "sacred" and "carving"; it was used by Greek and Latin writers to describe the sacred characters of the ancient Egyptian language. It is now applied also to other systems of writing in which figures of objects take the place of purely conventional signs, such as the characters used by the Chinese. (*See* Writing.)

HILL, JAMES JEROME (1838–1916). The career of James J. Hill, empire builder of the Northwest, was based on one great idea. He started out in life as a poor boy, and until he was 40 he had accomplished nothing more than hundreds of other successful business men. But years before he had conceived the idea of building a great railroad system through the undeveloped Northwest; and while his friends thought it was too much of a dream to be taken seriously, he kept working and planning till finally he got his opportunity. "From the time he first conceived it," said an old friend, "he was possessed by the railroad scheme. He used to talk it at all times. He ate and drank and slept with it."

THE "SHAGBARK"

The Shagbark Hickory has its name written all over it, hasn't it? And you know how the bark shells off. You can pick it out every time in the woods.

He was born near Guelph, Ontario, of Scotch-Irish parents; but upon the death of his father he left his job in a country store and came from Canada to the United States. He arrived in St. Paul, Minn., then a frontier village, when he was 18 years old, and took whatever work he could get. He was at various times shipping clerk, railroad station agent, and trader; and while he was a trader he traveled overland many times to Winnipeg, sometimes by oxcart, sometimes on horseback, and sometimes with dog sledges. In this way he came to know the Northwest; he saw its agricultural possibilities and he learned something of the great mineral wealth that lay in the Lake Superior region. He knew that a railroad, once built through that territory, would be a success. In the meantime he did what was nearest at hand and acquired a modest fortune.

Hill's chance came in 1878. With three other men he formed a syndicate which purchased the St. Paul and Pacific Railroad, a bankrupt line into which investors had poured millions of dollars. The road had never made any profits, and though it had a valuable right-of-way leading to the Northwest, comparatively little construction work had been done.

In just 15 years Hill had not only turned failure into success, but had extended the system across the continent to Seattle. This feat was accomplished, moreover, without government assistance, though it was a time when nearly every western railroad received public land grants. In the meantime he developed steamship lines on the Great Lakes and the Pacific and made them a part of what we now call the Great Northern system.

One secret of his success as a railroad builder was his intense interest in furthering the development of the Northwest. He did not sit back and wait for the country to become prosperous; he made it prosperous by encouraging homeseekers to settle in the new territory and assisting them on the road to prosperity. Importing pedigreed horses and cattle from England, and selling them at low prices to farmers, was typical of his methods of encouragement. In later years his sound and practical judgment on national problems of all sorts was eagerly sought.

HIMALAYA (*hĭ-mä′lȧ-yȧ*) **MOUNTAINS.** By comparison the Himalayan is not an extensive mountain system. Its length of 1,500 miles is but little longer than the Appalachians and its width is no greater than that of the Andes in Chile. But in elevation it is unique. From the southern of its two parallel ranges, between 40 and 50 peaks spring more than 23,000 feet in the air, overtopping all other mountains on the earth. Mount Everest, the highest of the Himalayas, is 29,002 feet, or over five and a half miles high; and the average elevation of the passes is 18,000 feet.

Lying on the northern frontier of India, the Himalayas extend from the great bend of the Indus River to the Brahmaputra of Indo-China, and separate the plateau of Tibet from the plains of the Ganges. They are located in the sub-tropic latitude, A VILLAGE ON THE SLOPES OF THE WORLD'S LOFTIEST MOUNTAINS

The hill tribes of India rarely have to complain of the heat, for they live away up in the Himalayas where it is usually cool. You see that they have nice warm houses neatly built of the stones of the mountains and with the windows high up, so that even the deep winter snows can't get into them. These hill tribes are largely of Mongol and Tatar race, descendants of the early invaders of India.

so the snow line is lifted to 16,000 feet. The lofty southern range forms a wall which intercepts the heat and moisture from the Indian Ocean. At some points on the southern slope 600 inches of rain fall in the course of a year, while the inner range and the Tibetan table-land are dry, cold, and half-desert.

Up to 5,000 feet on the southern slope the tea plant is cultivated in the famous gardens of Darjeeling and other places. Here, and at Simla and elsewhere, are fashionable pleasure and health resorts for civilians and British-Indian soldiers. Grains and fruits are grown up to 12,000 feet, and in the summer months herds of cattle are pastured on grassy slopes up to 18,000 feet. Tigers, leopards, and apes are perils of the habitable regions. The passes are blocked with snow from November to May. From melting snow and glacial fields, innumerable streams and cascades drop down through wild gorges to supply India's three great rivers with the floods which they pour every summer into the Indian Ocean.

Because of the majestic height and inaccessibility of many of the summits, the Hindus from ancient times have held the Himalayas in reverence as the home of the gods. Pious pilgrims still ascend to the source of the sacred Ganges for seasons of penitence and prayer. To people coming up from the steaming heat of the valleys, the greatest marvel of all is the snow-mantled, jagged ridgepole of this "roof of the world." The name Himalaya is from two Sanskrit words which mean "dwelling-place of the snow." (*See* Map with article on Asia.)

HINDENBURG, PAUL VON (1847–). When the World War broke out in 1914, General Hindenburg was 67 years old, a retired soldier living on his pension. In German military circles he was known chiefly as an enthusiast on the Mazurian Lakes region of East Prussia, which he had for years been demonstrating to be an ideal battlefield against an invasion from Russia. Even after his retirement he haunted the region, becoming intimately acquainted with every foot of the ground. Then the Russians overran East Prussia, and the test of his theory came. The emperor hurriedly telegraphed for him to take immediate command of the eastern army. By brilliant strategy Hindenburg kept two Russian armies apart while he closed in upon one of them and drove whole regiments into the lakes and bottomless mires. This Battle of Tannenberg was one of the greatest single disasters of the war.

The victory made him a national idol, and led the Kaiser to create him field marshal. In 1916 he was made chief of the German General Staff, succeeding von Falkenhayn. In 1917 his principal achievement was the German strategic retreat on the western front to the fortified "Hindenburg line," making possible the success of German operations in the east against Rumania and Russia. The German drive on the western front in 1918 was apparently due to Ludendorff's influence. In the collapse which followed, Hindenburg lent his aid to the new German government to prevent anarchy.

HINDUISM. The great majority of the peoples of India today are Hindus, and the name "Hinduism" is given to the strangely complicated combination of religious beliefs and social customs which governs them. Unlike other great religions it does not owe its origin to any single person, but seems to have grown up through the slow transformation of very ancient beliefs. When the Aryan conquerors (Hindus) first appeared in northern India, about 1500 B.C. (*see* India), there gradually arose a series of sacred writings in the Sanskrit called the *Vedas;* these expressed a lofty and mystical pantheism—that is, a belief in one "divine Being," which included all knowledge and all Nature within itself.

These Vedas show us this early Aryan society divided into four social castes—the Brahmans or priestly caste, the Kshatriyas or soldier caste, the Vaisyas or farmer class, and the Sudras or laborers. Early in their history, the Brahmans gained political as well as religious supremacy over the Kshatriyas, and established the religion called Brahmanism, set forth in writings called "Brahmanas," which are commentaries on the old Vedas. Gradually, pantheism gave way to a religion of personal gods, of which Brahma, the "Father of all," Vishnu, the "Preserver," and Siva, the "Destroyer," were the most important.

As the native tribes of India were conquered one by one by the Aryans, the Brahmans found it wise to allow the new converts to retain many of their old beliefs and primitive religious customs. Opposition to this adulteration of the old religion was in part responsible for the foundation in the 6th century B.C. of Buddhism and Jainism (*see* Buddha; India), but the Brahmans prevailed.

Today, Brahmanism has ceased to exist as a separate faith, being swamped beneath the mass of popular beliefs and rituals, and later introductions such as Mohammedanism and Christianity. Scores of sects have grown up, some emphasizing the worship of Vishnu, others of Siva, others setting up newer gods and goddesses. Most of the sects base their practices upon popular religious treatises of comparatively recent origin, called "puranas." At the same time the old fourfold caste system has split into thousands of branches and sub-castes, each with its peculiar rites and restrictions.

Most true followers of Hinduism, however, continue to look upon the Brahman caste as their leaders, and to observe broadly similar rules regarding food, marriage, and burial. One of the most interesting of the Hindu beliefs is the transmigration of souls, or "metempsychosis." According to this doctrine the soul of a person passes at death into some other creature, either human or animal. If the person has led a good life, the soul goes upward in the scale—a low-caste, for instance, is reborn as a high-caste; but if the person has led an evil life, the soul may pass into the body of a dog or a pig or any other animal. Everything in this life, say the Hindus, is a consequence of actions performed in a previous existence, and only by the gradual building up of a fine record or "karma" can final salvation be achieved. This doctrine is a very old one and was taken over in large part by the Buddhists when they split off from Brahmanism.

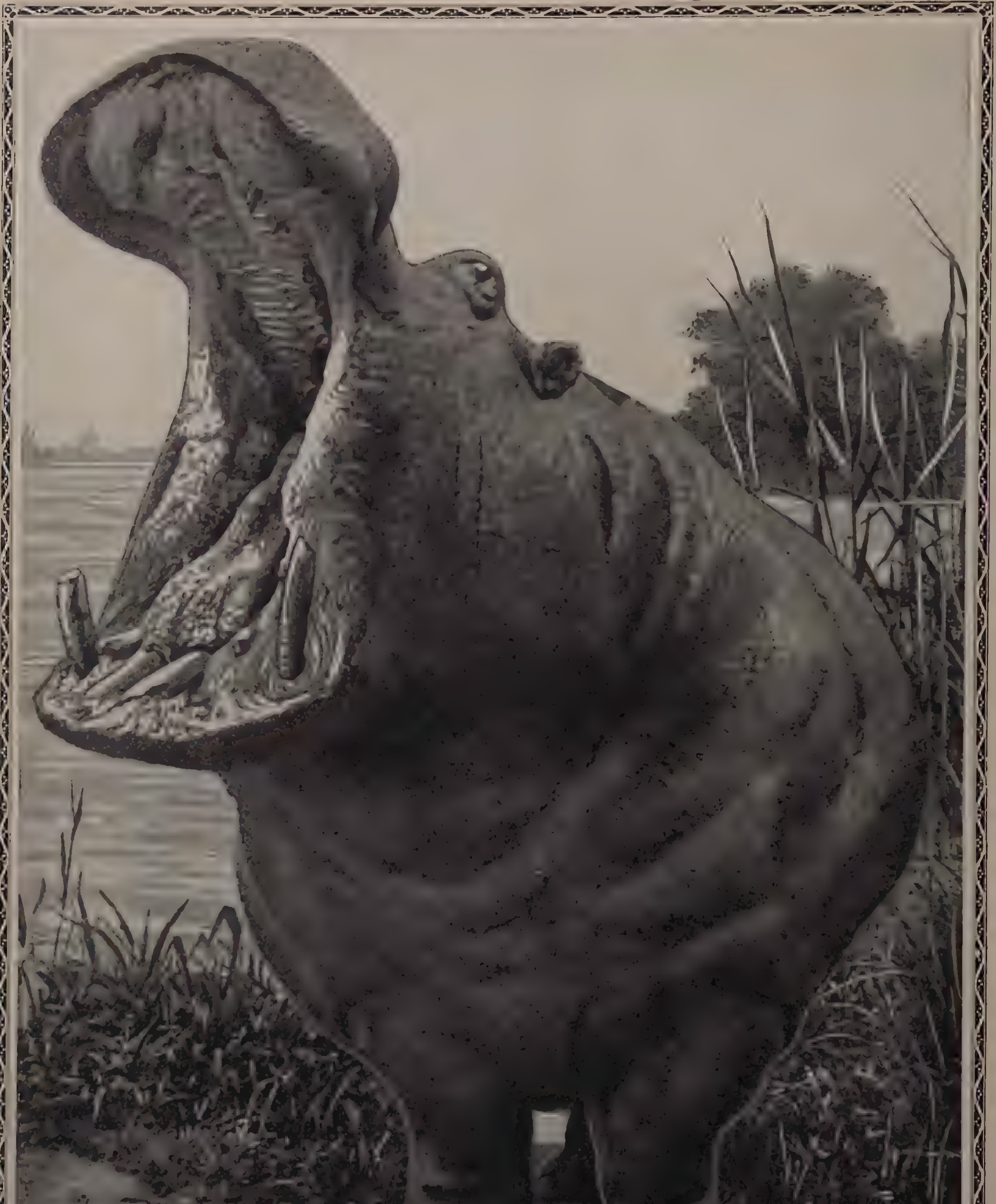
The Hindu gods are supposed to have undergone a series of incarnations or "avatars" similar to those through which men must pass. Thus the god Krishna is looked upon merely as a form of the god Vishnu.

HIPPOPOT'AMUS. "My, ain't he *plain!*" was one exclamation called forth by the first sight of a hippopotamus at the zoo. With its body like a sawed-off elephant, its little pig eyes, its broad-muzzled head, showing a frightful chasm when it yawns, the "hippo" is surely the "plainest" mammal in existence. Its ponderous clumsy body and short stocky legs would scarcely lead one to think of it as an expert swimmer and diver. But in fact it is more at home in the water than on land.

The name hippopotamus means "water horse," but this African animal is really related to the pigs. The hippopotamus is the largest existing land mammal next to the elephant. The largest specimens of the common hippopotamus measure 12 to 14 feet in length and about 5 feet or more in height, and may weigh as much as 4 tons. The body is covered with a hide 1½ inches thick on its back and sides, and hairless except at the tip of the tail. Its huge red mouth is furnished with large teeth—tusks in the lower jaw. It can close its large nostrils and short ears when under water.

During the day the hippopotamus remains in the water, often in herds of 20 to 40. At times it disappears beneath the water for 8 or 10 minutes at a time, spouting and snorting when it comes to the surface. When excited or in pain the body is covered with drops of a reddish fluid, which gives rise to the saying that the hippopotamus "sweats blood"; but the blood forms no part of this reddish sweat. At night the hippopotamuses (or hippopotami) go to pasture, feeding on water plants and grasses. They often journey 8 or 9 miles in search of good pasture and sometimes make inroads on cultivated fields. For this reason they have been exterminated in most settled districts. The natives also hunt the hippopotamus for its flesh as well as for its teeth, which are superior to ivory in hardness. The explorer Sir Samuel Baker says of a wounded hippopotamus, which he saw leave the water and gallop savagely inland: "I never could have imagined that so unwieldy an animal could have exhibited such speed. No man could have had a chance of escape."

HE'S A LITTLE TIRED—THAT'S ALL



You really couldn't ask a Hippopotamus to cover up his mouth when he yawns. It would take a bale of hay to conceal that cavity. In spite of his fearful looking pair of jaws, the "Water Horse" is timid and inoffensive unless he is infuriated. With those long tusks he can root up grass like a steam plow.

Though formerly plentiful in Egypt, the hippopotamus is now found only in equatorial Africa. It is thought that the common hippopotamus was found formerly in the Jordan valley also, and that it is the "behemoth" mentioned in the Bible. It is not difficult to keep in captivity. For many years a hippopotamus named "Miss Murphy" was to be seen in Central Park, New York, and it was always a delight to children to see the skill with which she caught in her huge mouth the loaves of bread tossed to her at feeding time.

In addition to the common hippopotamus there is a pygmy species (*Hippopotamus liberiensis*), about 2½ feet high and 6 feet long, which weighs when full grown only about 400 pounds. This species is found chiefly in Liberia and neighboring regions.

HISTORY'S PAGEANT through the AGES

HISTORY. To read history is like visiting strange far-off lands. Like travel, it takes us out of the narrowness and commonplace of everyday life, and shows us the wonderful panorama or moving picture of man in his slow ascent from earliest savagery to modern civilization. The stupendous series goes back to "the times of the old patriarchs with their flocks and herds, the keen-eyed Greek, the stately Roman, the watching Jew, the uncouth Goth, the horrid Hun, the settled picture of the unchanging East, the restless shifting of the rapid West, the rise of the cold and classical civilization, its fall, the rough impetuous Middle Ages, the vague warm picture of ourselves and home."

Someone has said that "History is Philosophy teaching by example." Certainly to be "historically minded" is to see things in relation and in perspective, to judge tolerantly, remembering how differently men have thought and acted in different times, and always to keep an open mind, ready to receive and weigh new evidence. If one grasps this idea, he will never think that being a historian means an ability to remember dates. That childish idea is like calling a man a statesman who can remember the names of voters in his districts. A waiter could remember more names and a telephone operator more numbers than the greatest historian.

The true historian is not content to take all his facts from other historians. Today he makes sure that his statements are based on sound "documents" or "sources" which go back to the time of the facts themselves. Those sources are of all kinds—ruined monuments, old tombs, and other material remains; legal papers, letters, diaries, newspapers, and written or printed narratives of eye-witnesses, even myths and fables; contemporary pictures, drawings, photographs, and the like. Sometimes the discovery or the finding the key to new sources—such as the hieroglyphs of ancient Egypt or the cuneiform tablets of Babylonia and Assyria—adds whole new realms to our historical knowledge.

But the historian needs continually to be on his guard not to be misled by his sources. A document may be entirely forged; its author may be deliberately lying; he may be so prejudiced by national, religious, party, or personal bias as to be grossly unfair to the other side; and if honest, he may be misinformed as to the facts and mistaken in his inferences. Scores of pitfalls must be avoided by the research worker in this fascinating field.

Anyone who reads the accounts put forth by the different countries concerning the origin of the World War, or who sees how widely the reports of political affairs in Republican newspapers differ from those in Democratic ones today, will realize that the historian needs caution and training in handling his sources.

"Criticism for good faith and accuracy" has become a special branch of learning. Every trained historian asks, "Did this writer mean to tell the truth?" And second, "Was he in a position or frame of mind to tell the truth even if he wanted to?" Every statement therefore must be patiently weighed and tested, and combined with all other available information to get at the truth. As a result of such training it has well been said that "by the mechanism now at his command the scientific explorer can read more history from the dust heaps of Abydos than Herodotus, the greatest traveler of antiquity, could gather from the Egyptian priests of Saïs."

Formerly history was regarded chiefly as a branch of literature, and a pleasing style was considered of first importance. Today the emphasis is placed, as in science and other branches of study, mainly upon accuracy of facts, and the soundness and breadth of the understanding which the historian presents of man's life in the period with which he deals.

> *"In a certain sense all men are historians. Is not every memory written quite full with Annals, wherein joy and mourning, conquest and loss manifoldly alternate; and, with or without philosophy, the whole fortunes of one little inward Kingdom and all its politics, foreign and domestic, stand ineffaceably recorded. . . . Thus, as we do nothing but enact History, we say little but recite it: nay rather, in that widest sense, our whole spiritual life is built thereon. For, strictly considered, what is all Knowledge too but recorded Experience, and a product of History; of which, therefore, Reasoning and Belief, no less than Action and Passion are essential materials?"—Thomas Carlyle.*

History is really a ceaselessly flowing stream, ever widening and deepening its course; but for convenience we divide it into more or less artificial periods. This does no harm if we remember that changes in history, like changes of the seasons, are gradual, and each period passes into the next as imperceptibly as winter into spring, or as life undergoes the slow but constant changes from childhood to youth, manhood, and old age.

To the long period before written records begin when man was taking his first steps in the arts which make up civilization, we give the name Prehistoric Age (*see* Stone Age). Ancient History covers more than half the span of our recorded knowledge. It stretches from the beginnings of Assyrian and Egyptian inscriptions, through "the glory that was Greece, the grandeur that was Rome," to the coming into the Roman Empire of the Germanic barbarians who overthrew classical civilization (about 3000 B.C. to about 375 A.D.).

The Middle Ages extend from 375 A.D. to about 1500. This period starts with an epoch of confusion and transition which lasts to about 800 A.D.; to it (if anywhere) the term "Dark Age" may be applied. Then comes the height of the Middle Ages, from Charlemagne to Dante (800 to 1300), when feudalism, monasticism, scholasticism, the Crusades, and Gothic architecture flourished, and a world empire and a world papacy confronted each other and strove for mastery. The period closes with a second epoch of transition (1300 to 1500), which we call the Renaissance (*see* Renaissance). Since 1500 we have the Modern Period, characterized by the organization into national states, the spread of discovery and European settlement, the progress of science and inventions, and the rise of democracy.

Altogether, written records go back only about 5,000 years. Geologists, however, believe that the earth is at least 100,000,000 years old, and that man has perhaps inhabited it for 50,000 years. To give some idea of the short duration of recorded history compared with this vast expanse of time, Prof. J. H. Robinson asks us to imagine a library of ten volumes of a thousand pages each, one page for every 5,000 years that the earth has existed. The whole of recorded history from the earliest Assyrian and Egyptian inscriptions to the present day would scarcely cover the last page of that stupendous journal!

If history as a study is often dull and dry, a mere catalog of names and dates of rulers and battles and treaties, it is the fault of the books and not of history itself. Nothing can be more fascinating than the true story of how men and women have lived their lives in the past and in far distant lands—their houses, food and clothing, how they cultivated their fields and manufactured goods and traded with their neighbors, the games their children played and the parents' beliefs about God and the world of Nature, their laws and manner of government, the songs their poets sang and the beautiful things their artists made. All of this is included in the history which scholars today study and teach.

Even wars and political struggles are interesting when we once know what they were about and how they were carried on, and become well enough acquainted with the heroes and leaders to feel that they were real men and women dealing with things that were of vast importance to their peoples. The great English historian Freeman once wrote that "History is past Politics and Politics present History." But this view, equally with the "drum and trumpet" view of history, is too narrow; and today the historian includes in his survey the whole life of man in the past as discoverable from documents and all other "sources" which may shed light on the subject.

HISTORY SHOWN IN CHARTS

HISTORICAL charts are to history what maps are to geography. They help us to visualize the facts—to fix them in *time* as maps do in *space*—and so aid both the understanding and memory. When the history of the chief countries is shown in parallel columns, as here, there is the added advantage of "synchronizing" the events.

A glance across these pages will enable you to see at once what was happening in the different countries in any period. Thus a child will quickly discover that when the Greeks were besieging Troy, the great empire in Egypt was already declining, Samuel was ruling in Israel, and Tiglath-Pileser I and his wandering armies were gazing out across the Mediterranean. He will learn that some of the Norman knights who invaded England with William the Conqueror lived to take part in the First Crusade, and that shortly before that conquest the Northmen discovered America; and that in the same century that the Puritans were settling Plymouth and Boston, there was revolution and civil war in England, Huguenots were persecuted in France, a great religious war was fought in Germany, and the Dutch finally won their independence from Spain. This graphic arrangement of contemporaneous events is particularly valuable in teaching the child to regard history, not as a collection of disconnected incidents, but as a series of related movements, each contributing to the progress of civilization and the advancement of the human race.

PREHISTORIC PERIOD

125,000(?)-10,000(?) B.C. **Old Stone Age.** 25,000(?). **Last Glacial Age Ends.** 10,000(?). **Neolithic (New Stone) Age Begins**

HISTORIC PERIOD —— I. ANCIENT HISTORY

B. C.	EGYPT	PALESTINE AND SYRIA	BABYLONIA AND ASSYRIA	AEGEAN REGION AND GREECE	ITALY
	New Stone Age in Nile Valley. **Predynastic period;** many little kingdoms. 4241. **First fixed date in history;** Egyptian calendar established. 3400. **Menes** unites Egypt into one kingdom; beginning of **dynastic period.**		5000–2750. **Sumerian city kingdoms** (non-Semitic). Early development of cuneiform writing.	New Stone Age in **Crete** before 4000.	New Stone Age in Italy.
3000	3000–2500. **PYRAMID AGE;** high cultural development under IVth Dynasty; capital at **Memphis** (lower Egypt). Great Pyramid at Gizeh (2900). 2400. Removal of capital to **Thebes** (upper Egypt).	3000–2500. **Canaanites,** a Semitic people, move into Palestine. 2550–2000. **Phoenicians** (another wave of Semites) settle in Palestine.	2750–2550. **Semites** under **Sargon** of Akkad **conquer Sumeria.** 2500–2200. Rule of Semitic kings of Sumer and Akkad; Babylonian Empire. 2130–2090. **Hammurabi of Babylon** conquers Akkad and Sumeria (**code of laws** issued).	3000–2800. Transition from Stone to Bronze Age. Dawn of European civilization in **Crete.** 2800–1200. **Minoan Age in Crete;** high civilization with capital at Cnossus. 2500–2000. Second city of Troy flourished.	
2000	2000–1800 Height of **FEUDAL AGE.** 1800–1600(?). Hyksos kings. 1580. Founding of New Empire (XVIIIth Dynasty). 1501–1447. **Thutmose III** conquers Palestine, Phoenicia, and Syria; **greatest conqueror among Pharaohs.** 1411–1375. **Amenhotep III;** magnificent palaces and temples at Thebes. 1375. **Amenhotep IV** (Ikhenaton) tries to reform old religion. 1225(?). **Rameses II** (Sesostris) completes Great Hall at Karnak. 1150. Beginning of **Egyptian decline.**	2000. **Abraham** leaves Ur, in southern Babylonia; enters southern Palestine. 1550. **Joseph** and his brethren go into Egypt. 1400–1200. **Great immigration of Hebrews** (Jews) **into Canaan.** 1225(?). **Moses** leads Jews out of Egypt; the Ten Commandments. 1200–1030. **Rule of Judges; Samuel** the last judge. 1030. **Saul** becomes first king of the Jews.	1900. **Assyria** (north) **settled** by immigrants from Babylonia (south). Kassite immigrants from **Elam** gradually absorb power in Babylonia and establish Kassite dynasty (1780–1200?). 1400. Babylonia has well-established diplomatic and commercial relations with Egypt. 1300. **Constant wars of Assyria with Babylonia.** 1100. **Tiglath-Pileser I** of Assyria conquers to the Mediterranean.	2000–1500. 3d, 4th, and 5th cities of Troy built. 1600–1100. 6th city of Troy built (Homeric city). **1500-1450. GOLDEN AGE OF CRETE.** 1500–1100. Greatness of **Mycenae,** Tiryns, etc. 1450–1200. **Hittite Empire** in Asia Minor. 1500–1000. Greek (Achean) **colonization of Greece** and islands. Dorian and Ionian conquests and colonization follow. **1100. Fall of Troy** following siege by Greeks; gradual growth of hero songs about the siege.	2000. Lake dwellers occupy Italian lakes.
1000	945. Libyan rulers succeed line of priestly rulers of Thebes (XXIst Dynasty). 926. Sheshonk I plunders **Jerusalem** (XXIId Dynasty).	1000. **David** becomes king; capital at Jerusalem 1000–700. **Phoenician cities at height of their power.** 960. **Solomon** becomes king; temple dedicated. 930. Kingdom divided into **Israel** and **Judah.** 926. **Jerusalem plundered** by Egyptians.	930–626(?). **Brilliant period of Assyrian history** (great activity in architecture, literature, and sculpture as well as in military conquests).	1000–900. **Greek colonization** of Aegean islands and Asia Minor extended.	1000. **Etruscans** come into Italy (probably from Asia Minor by sea). 1000. **Latin** villages established along Tiber
900		**Period of the Prophets** (Elijah, Elisha).	885–860. Assurnazirpal restores the empire of Tiglath-Pileser I; marches to Mediterranean.	900–800. **'Iliad'** and **'Odyssey'** composed (by Homer?). 820. **Lycurgus** frames laws for Sparta.	
800	800. Egypt again divided among **many small kingdoms** (XXIIId Dynasty).	The Prophets: Amos, Joel, Hezekiah, Isaiah.	**750-606. ASSYRIAN EMPIRE** at its height. 742–727. **Babylonia subjugated** by **Tiglath-Pileser III** of Assyria. Assyrian rule extended to **Egypt.**	800–700. **Rise of aristocracies** in Greece. 776. Traditional date of first record of Olympic games (**1st Olympiad**). 750–650. **Sparta** conquers Messenia; becomes a military power.	**753** (traditional date). **Rome founded.** 750. Etruscan kings invade Latin towns.

I. ANCIENT HISTORY *(Continued)*

B. C.	EGYPT	PALESTINE AND SYRIA	BABYLONIA, ASSYRIA, AND PERSIA	GREECE	ITALY AND ROME
	722. **Ethiopian rulers** gain Egyptian throne (XXVth Dynasty).	722. **Israel destroyed**; people carried to **Assyria**. 701(?). Assyrians besiege Jerusalem (**Isaiah's** prophecies).	722–705. **Conquests of Sargon II** (palace of Nineveh). 722. Conquest of Israel; people made captive. 705–681. **Sennacherib; walls and temples of Babylon razed** following revolt.	734 (traditional date). **Syracuse** founded in Sicily. 708. **Tarentum** founded in Southern Italy	
700	670–661. **Assyrians conquer Egypt; plunder** Thebes. 663. Egyptian rulers restored (XXVIth Dynasty); **revival of power and art.** 609–594. Necho II digs **canal from Nile to Red Sea**; Africa circumnavigated.	Prophet **Jeremiah.**	681–668. **Esarhaddon; Assyria at its height.** 640. **Revolt of the Medes.** 606–604. **Chaldeans** move into Assyria from the desert; **Nineveh destroyed; end of Assyrian Empire.** 606–539. **CHALDEAN (NEW BABYLONIAN) EMPIRE.** 604–561. **Nebuchadnezzar;** wars in Palestine and Syria; **Hanging Gardens of Babylon built.**	650–600. **Rise of tyrannies** in Ionia; established in **Corinth,** Megara, etc. 630. Cyrene founded in Africa. 621. Code of Laws for Athens issued by **Draco.**	700. **Greek colonies in Sicily and Southern Italy.**
600	525. Psammetichus III conquered; Egypt a **Persian province.**	586. **Jerusalem** captured by Babylonians; temple burned (**Babylonian captivity**). 539. **Return of Jews**; temple rebuilt; Palestine subject to **Persia** (until 332). Prophet **Zechariah.**	586. Capture of **Jerusalem; Jews** carried to Babylon. 539. **Babylon taken by Cyrus the Great;** becomes Persian province. 539-330. **MEDO-PERSIAN EMPIRE.** Lydia conquered (capture of Sardis, 546). 528–521. Cambyses; conquers **Egypt.** 521–485. **Darius I rules from Aegean and Egypt to India;** advances to Danube against Scythians (513); revolt of Greeks in Asia Minor (500); **two expeditions against Greece** (493, 490).	594-593. **Solon,** archon of Athens, **reforms Athenian constitution.** 560–527. **Pisistratus** tyrant of Athens. 514. Hipparchus, son of Pisistratus, slain by Harmodius and Aristogiton; his brother Hippias expelled, 510. 509. **Reforms of Clisthenes** at Athens.	510 (traditional date). **Kings** (Etruscans?) **expelled from Rome: republic founded.**
500	Frequent **revolts** against Persian rule. 414. Successful revolt re-establishes **Egyptian independence for 60 years.**	458. **Ezra** returns to Jerusalem. 445. **Nehemiah rebuilds Jerusalem.** **Malachi** last of the Old Testament writers.	486–465. **Xerxes.** Great expedition against Greece (480). Internal decay of Persian Empire; frequent revolts of Egypt, etc. 401. Unsuccessful revolt of Cyrus the Younger against his brother, Artaxerxes II; **retreat of Xenophon** and the 10,000 Greeks.	500. Athens aids Greeks of Asia Minor against Persia. 493–492. **Themistocles** archon of Athens. 493-479. **Persian Wars.** Darius sends expedition into Thrace and Macedonia (493); attacks Greece (**Marathon, 490**); **Xerxes invades Greece (Thermopylae and Salamis,** 480; **Plataea,** 479). 478. An **Athenian Empire** founded by Confederacy of Delos, against Persians; **Athens and Sparta at head of rival leagues.** 444-429. **AGE OF PERICLES,** height of Athenian culture. (Aeschylus, Sophocles, Euripides, Aristophanes, Herodotus, Thucydides, Phidias, Ictinus, Socrates, Zeno.) Acropolis developed; Parthenon built. 431-404. **Peloponnesian Wars** between Athenian and Spartan alliances; Athenian expedition to Syracuse unsuccessful (415-413); Spartans besiege Athens (413–404); Athenian fleet destroyed at Aegospotami (405); **surrender of Athens.**	494. Struggle between **Patricians** and **Plebeians;** tribunes created. 450. Roman laws made public (12 tables).
400	343. New Persian conquest of Egypt by Artaxerxes III.	Sidon chief city of Phoenicia. 346. Revolt of Sidon suppressed by Artaxerxes III with great cruelty.	362–338. Artaxerxes III King of Persia; poisoned by his Egyptian favorite Bagoas.	399. **Socrates put to death** in Athens. 379–362. War between Sparta and Thebes (**Epaminondas**); Leuctra (371); **leadership passes to Thebans.** 357–355. **Revolt** of Athens' allies **destroys Athenian Empire.** 359–336. **Rise of Macedon to power under Philip** (power of Thebes destroyed at Chaeronea, 338). **Macedonian supremacy in Greece.** 336-323. **Alexander the Great.** Invades Asia and founds Greek (Hellenistic) power of far-reaching influence.	396. Romans take **Veii** after 10 years siege; end danger from Etruscans. 390. **Gauls plunder Rome** (Battle of the Allia). 367. Licinian laws passed to **equalize Patricians and Plebeians.** 343–341. First war against Samnites (kindred mountain tribes southeast of Rome). 340–338. Revolt of Latins crushed; Latin League dissolved.

MACEDONIAN EMPIRE

334. **Alexander attacks Persian Empire** (Battle of the **Granicus**, 334; of **Issus**, 333; of **Arbela**, 331).
332. **Palestine** conquered by Alexander.
332. **Alexander conquers Egypt** from Persia and founds **Alexandria.**
330. Darius III slain while fleeing after Arbela; **end of Persian Empire.**
323–276. **Wars among the successors of Alexander** (Diadochi), who divide the Macedonian Empire.

EGYPT	PALESTINE	SYRIA AND ASSYRIA	GREECE	
323-30 B.C. **Ptolemies** (descendants of one of Alexander's generals) rule Egypt; great library at Alexandria.	323–276. Ptolemies rule Palestine.	312–281. **Seleucus,** son of one of Alexander's generals, **rules from Syria to the Indies** (his descendants called Seleucids).	323–146. Macedonia and Greece under Demetrius Poliorcetes and his descendants. 323–322. Greek states fail in revolt against Macedonians.	326–304. Second Samnite War. Roman army defeated in the **Caudine Forks** and sent "under the yoke" (321). Victories of Romans at Vadimonium Lake (310) and Bovianum (305) end the war. Rome becomes the **dominant power of Italy south of the Rubicon River.**

I. ANCIENT HISTORY *(Concluded)*

B. C.	EGYPT	PALESTINE	SYRIA AND ASSYRIA	GREECE	ROME
300	285–246. **Ptolemy II** (Philadelphus); brilliant court at Alexandria; Egypt's navy rules eastern Mediterranean.	276. **Antiochus** of Syria conquers Palestine from Egypt.	250. **Parthians** under Arsaces revolt. 223–187. **Antiochus the Great**; defeated by Romans at **Magnesia** (190); Seleucid rule curtailed in west.	280–183. **Aetolian and Achean Leagues** prevent Macedonia securing complete power in Greece.	282–272. War with Tarentum aided by King **Pyrrhus** of Epirus. 264–241. **First War with Carthage** (over Sicily). Rome becomes a naval power, invades Africa and Sicily, and defeats Carthage in numerous battles at sea. **Rome gains Sicily.** 218–202. **Second War with Carthage. Hannibal** invades Italy over the Alps; defeats Romans at **Cannae** (216); Scipio carries the war into Africa (204), and defeats Hannibal at **Zama** (202). Carthage becomes a vassal state. 215–206. First Macedonian War.
200	Decline of Egypt: frequent wars of **Ptolemies** with the **Seleucids** of Syria.	167–130. **Maccabees** (kings) rule Palestine as Roman vassals.	174–136. **Mithridates I founds Parthian Empire** (Media, Persia, Babylonia, etc.).	197. Macedonians defeated at **Cynoscephalae** by Romans, and **Greece freed from Macedonian rule.** 146. Achean League defeated by Romans and **Corinth destroyed. Greece passes under Roman rule.**	200–197. Second Macedonian War; Greece freed. 190. **Antiochus of Syria overthrown** (western Asia Minor under Roman control). 171–168. Third Macedonian War; **end of Macedonian monarchy.** 149–146. **Third War with Carthage;** Carthage destroyed. 146. **Macedonia becomes a Roman province.** 133. **Practically all Spain under Roman rule.** 133–123. Tiberius and Caius **Gracchus** attempt to reform the land laws and are slain. 113–101. Cimbri and Teutones (Germanic invaders) defeated by **Marius.**
100	Civil wars among degenerate Ptolemies **pave way** for fall. 47. **Cleopatra** made ruler of Egypt under Roman supremacy. 31. Cleopatra and Antony defeated at **Actium.** Egypt becomes a **Roman province.**	63. Pompey makes Jews **tributary** to **Rome.** 40. **Herod** (the Great) recognized by Rome as **dependent king** of **Judaea.** 4. **Birth of Christ.**	88–64. **Mithridates VI** (the Great) defeated by Romans; **Syria and Armenia submit to Rome.**		90. **Roman citizenship granted to all Latins and most other Italians,** following revolt of Rome's allies ("Social War," 90–88). 88–82. **Civil War between Sulla** (wealthy classes) **and Marius** (poorer classes). Reactionary reign of terror under Sulla as dictator. 73–71. Revolt of gladiators and slaves under **Spartacus.** 66–62. **Catiline's conspiracy** (Cicero's speeches). 60. Caesar, Pompey, and Crassus form **first Triumvirate.** 58–51. **Caesar conquers Gaul;** two expeditions to **Britain** (55–54 B.C.). 49–48. **Civil war between Caesar and Pompey** (Battle of **Pharsalus;** Pompey slain). Under forms of the republic, Caesar gets all power into his own hands. 44. **Assassination of Caesar** by Brutus, Cassius, and others. 43–42. Mark Antony, Octavian (Augustus), and Lepidus form **second Triumvirate** and defeat Cassius and Brutus at **Philippi.** 31–30. War between Octavian and Antony; Antony and Cleopatra of Egypt defeated at **Actium.** **31 B.C.–14 A.D. Octavian rules as Emperor Augustus. Beginning of ROMAN EMPIRE.** (Golden Age of Roman culture; Livy, Horace, Vergil, Seneca, Pliny the Elder.)
TIME B.C.					
TIME A.D.	Under Roman rule Egypt enjoys a period of industrial and commercial prosperity.	6. **Judaea** becomes part of **Roman province of Syria.** 70. **Jerusalem destroyed** by Titus following revolt. Dispersal of survivors.			14–37. **Tiberius** emperor (stepson of Augustus). 37–41. Caligula (great-grandson of Augustus). 41–54. Claudius; **Britain added to Roman Empire.** 54–68. **Nero;** his crimes and excesses; **great fire in Rome; Christians persecuted.** 69–79. **Vespasian** proclaimed emperor by his troops in Syria; good rule. 79–81. **Titus** (son of Vespasian). 79. **Eruption of Vesuvius destroys Pompeii and Herculaneum.** 98–117. **Trajan,** a Spaniard by birth and a great general (conquest of Dacia; defeat of Parthians in Syria; Empire reaches greatest extent).
100	Revolt of native troops begins **decline of Egypt.**	132–135. **Revolt of Jews** suppressed by Hadrian; **survivors dispersed.**	114–116. **Armenia,** Mesopotamia, and Assyria made **Roman provinces.** 193–211. Northern Assyria conquered by Rome.		117–138. **Hadrian** adopted by Trajan; frontiers strengthened; **Asia east of Euphrates given up;** magnificent buildings. 138–161. **Antoninus Pius.** 167–180. **Marcus Aurelius,** adopted son of Antoninus and a renowned Stoic philosopher. Wars with barbarians along Danube. 193–284. Emperors elected by the army. 193–211. Septimius Severus; war in Mesopotamia; northern Assyria conquered.
200	270. Egypt occupied by Zenobia of Palmyra. 273. Egypt reconquered by Rome.		226–241. **New Persian Empire** under **Sassanids.** 267–273. **Zenobia, queen of Palmyra,** defeated by Aurelian.		212. **All freemen in the Empire made citizens** (to get more taxes). 270–275. **Aurelian;** recovers Palmyra and subdues revolt in Gaul; new walls about Rome. 284–305. **Diocletian** (resides in East); **empire divided** into four administrative prefectures; **great persecution of Christians; abdicates.**
300	Quarrels between branches of the Christian Church lead to **persecution of the Arians.**				311. **Christianity made legal.** 323–337. **Constantine the Great sole ruler; capital removed to Constantinople;** empire reorganized. 325. Council of Christian church at **Nicaea.** 375. **Beginning of TEUTONIC MIGRATIONS into the Empire.** 378. **Visigoths** defeat Roman army at **Adrianople.** 379–395. **Theodosius the Great,** last ruler of united empire. 395. Empire divided into **Eastern** and **Western** parts.
400					**395–476. WESTERN EMPIRE.** 410. **Alaric the Visigoth captures Rome.** 455. **Vandals** from Africa sack Rome. 476. **German leader Odoacer deposes last Roman emperor in West.** **395–1453. EASTERN OR BYZANTINE EMPIRE.** For nearly 1,000 years a defense against Asiatic invasions.

II. MEDIEVAL AND MODERN HISTORY

	WESTERN EUROPE		ENGLAND	EASTERN EUROPE AND OTHER COUNTRIES
	383–394. Wars for power among claimants of Empire in West ended by recognition of Theodosius (*see* Eastern Europe). 395–423. Honorius receives **Western Roman Empire** on permanent division (Stilicho, his minister).		**Romans** rule Britain since about 43–81 A.D.; Christianity introduced; **Hadrian's wall** begun (121).	375. Visigoths cross Danube; defeat Romans at Adrianople (378). 395. Death of Theodosius the Great, last ruler of united Roman Empire. **395–1453. EAST ROMAN EMPIRE** (Arcadius emperor, 395–408).
400	410. **Sack of Rome** by Visigoths under **Alaric;** Visigoths move into Spain (414). 429. **Vandals** cross from Spain into Africa; under Genseric **plunder Rome.** 451. **Attila** the Hun defeated at Châlons (in Gaul). 476. Odoacer, German mercenary, displaces Roman emperor; **end of Western Roman Empire.** 481–511. **Clovis founds kingdom of Franks** in Gaul (Merovingians); becomes **Christian** (496). 493–555. **Ostrogoths** (**Theodoric the Great**) rule Italy.		410. Roman legions withdrawn. 449–700. **Angles, Saxons, and Jutes conquer Britain** ("Angleland" or England).	474–491. Zeno eastern emperor.
500	511–751. Decline of Merovingian kings of Franks and **rise of Mayors of Palace.** 568–774. **Lombard** kingdom in Italy. 590–604. **Pope Gregory I** (**the Great**); Rome the head of Christendom.		577. Battle of Deorham; West Saxons reach Bristol Channel. **597. Augustine reintroduces Christianity.**	**527–565. Justinian emperor;** Roman law codified; Vandals in Africa and Ostrogoths in Italy overthrown.
600	613. Queen **Brunhilde** of Austrasia (Eastern Frank-land) captured, tortured, and dragged to death by wild horses in Merovingian quarrels. 687. Pepin of Heristal becomes Mayor of Palace for whole Frankish kingdom (Battle of Testry).		607. Chester sacked and left desolate for 300 years.	622. Mohammed's flight from Mecca (the "Hegira"); **founding of Mohammedan religion.**
700	711. Mohammedans from Africa overthrow Visigothic kingdom in Spain. 732. Franks (**Charles Martel**) defeat Mohammedans at **Tours** (in France). 751. Pepin the Short (Mayor of the Palace) deposes last Merovingian king and takes the crown (Carolingian rule).		755–794. Offa king of Mercia.	750. Mohammedans rule all western Asia, northern Africa, and Spain—from Indus River to the Pyrenees.
800	800. **Charlemagne, king of the Franks** and ruler of most of western Europe **(768–814), crowned emperor at Rome.** **843. Partition of Verdun.** Charlemagne's empire divided; separation of **France** and **Germany.**		827. Egbert of Wessex **unites England.** **871–899. Alfred** rules southern England; Danes checked.	809. End of brilliant reign of **Harun-al-Raschid, calif of Bagdad.** 862. **Russian kingdom founded by Rurik the Northman** (Kief, capital).
900	**FRANCE** 911. Normandy ceded to Rolf (Rollo), the Northman; decline of Carolingians in France. **987. Hugh Capet chosen king** (Capetian line); **Feudalism** at height of its power.	**GERMANY AND ITALY** 911–918. Conrad I (Franconian) first non-Carolingian king. **936–973. Otto I, the Great** (Saxon), ends anarchy in Italy; defeats Hungarians (955); **revives Empire** (962).	910–954. Northern England ("Danelaw") reconquered from Danes. 980. Danish invasions renewed.	905–959. Constantine VII ("Born in the Purple") emperor, patron of literature.
1000	1096. Council of Clermont; Pope Urban II calls First Crusade.	1002–24. Henry II (the Saint), **last of the Saxon line.** 1075. **Investiture conflict begun** by Pope Gregory VII (**Hildebrand**) and Emperor Henry IV (1056–1106).	1016–1035. **Canute** of Denmark king. 1042–66. Edward the Confessor king. **1066. Norman conquest** (William I).	1000. **Northmen discover America** (Greenland discovered, 984).
	PERIOD OF THE CRUSADES—TO RESCUE PALESTINE FROM MOHAMMEDAN RULE—1096-1291 **1096-99. First Crusade. People's crusade under Peter the Hermit fails. Crusade of nobles under Godfrey of Bouillon and others takes Jerusalem (1099) and establishes a feudal kingdom of Jerusalem.**			
1100	1108–37. **Louis VI** (**the Fat**) establishes order in crown possessions.	1122. Concordat of Worms ends investiture conflict.	1100–35. Henry I ("the Lion of Justice"); a charter issued.	1144. **Edessa** taken by Mohammedans.
	1147-49. Second Crusade. Preached by St. Bernard of Clairvaux; led by Conrad III of Germany and Louis VII of France without results.			
	1180–1223. **Philip Augustus;** recovers **Normandy,** etc., from England.	1152–1190. **Frederick Barbarossa** (**Hohenstaufen**); quarrel with pope; defeated by league of Lombard towns.	**1154–89. Henry II** (**Plantagenet**) holds **Normandy, Anjou, Maine,** etc., in France. Conquest of **Ireland** begun.	1187. Capture of **Jerusalem** by **Saladin.**
	1189-92. Third Crusade. Led by Richard Coeur de Lion of England and Philip Augustus of France; Emperor Frederick Barbarossa drowned on way. Armistice with Saladin permits pilgrimages to Holy Places.			
1200	1209–29. **Albigensian crusade.** 1214. Battle of Bouvines; defeat of English and enemies of Frederick II. **1226–70. Louis IX** (**St. Louis**); good rule. **Crusade to Egypt** (1248–54); to **Tunis** (1270). **1285–1314. Philip IV** (the Fair). Power of king increased; quarrels with pope.	1200–1450. **Hanseatic League** between German cities promotes commerce. 1215–50. **Frederick II;** rules Naples and Sicily as well as Empire; quarrels with pope; **Fifth Crusade** (1228–29). 1256–73. **Interregnum in Empire.** 1273–91. **Rudolph of Hapsburg** king of Germany. 1295. Marco Polo returns from 20 years' travels in China and the East.	1204–06. **King John loses Normandy and Anjou;** forced to grant **Magna Carta** (1215). **1272–1307. Edward I;** conquest of **Wales** (1282); wars with **Scotland** begun. 1295. **Model Parliament** called.	**1202–04. Fourth Crusade** directed against **Constantinople** by **Venetians.** 1206–27. **Genghis Khan** conquers China, Persia, Turkestan, and Southern Russia. **1291–1499. Growth of Swiss Confederation** (Battle of Morgarten, 1315; Sempach, 1386). 1297. Fall of Acre; end of Crusades.
1300	1302. First meeting of **Estates-General.** 1302. Battle of **Courtrai;** Flemish townsmen defeat French knights. **1305–77. "Babylonian captivity of Popes"** (papal residence at Avignon, France). 1328. Philip VI (Valois) becomes king. **1337–1453. Hundred Years' War with England** (Peace of Bretigny, 1360; war renewed, 1369). 1364–80. **Charles V** (**the Wise**). Most of English possessions in France won back by **Du Guesclin.**	**PERIOD OF ITALIAN RENAISSANCE** **1300–1500.** Dante, Petrarch, Boccaccio, Giotto, Michelangelo, Da Vinci, Raphael, Titian. 1347–1437. Emperors of **Luxemburg-Bohemian line.** 1348. **Black Death** appears in Florence and spreads over Europe. 1356. Charles IV issues **Golden Bull.** 1377. Papacy returns from Avignon to Rome. **1378–1417. Great Schism** (two, later three, claim to be pope). 1380. **Venice crushes Genoa** at Chioggia.	1314. Edward II defeated at **Bannockburn** by Scots under **Bruce.** **1327–77. Edward III.** **1337–1453. Hundred Years' War with France.** English victories at **Crécy** (1346) and **Poitiers** (1356). 1381. **Peasants' revolt led by John Ball** and Wat Tyler. **1399. Henry IV** (**Lancaster**) overthrows Richard II.	1331–55. Stephen Dushan rules an extended Serbian Empire. 1354. **Ottoman Turks** gain foothold in Europe (Gallipoli). 1389. Serbs defeated by Turks in great battle at **Kossovo.**

II. MEDIEVAL AND MODERN HISTORY—(*Continued*)

	FRANCE	GERMANY	ITALY AND PAPACY	GREAT BRITAIN	OTHER COUNTRIES
1400	1415. Hundred Years' War renewed in reign of Charles VI (insane after 1392). 1429–31. **Joan of Arc saves France.** (War ends in 1453: England loses all its possessions in France except Calais.) 1461–83. **Louis XI** strengthens France. 1477. **Charles the Bold** of Burgundy overthrown; his duchy annexed to France. 1494. **Charles VIII invades Italy** (Italian wars begun).	1410–37. Sigismund emperor. 1419–36. **Hussite Wars.** (**Ziska** blind leader against Germans.) 1440–93. **Frederick III** (**Hapsburg**) emperor. 1450. Gutenberg invents printing. 1493–1519. **Maximilian I** emperor.	1414–18. **Council of Constance;** schism ended; **John Huss** burned as heretic (1415). 1469–92. **Lorenzo de Medici** rules Florence. 1494–98. **Savonarola** attempts reform in Florence.	1415. **Henry V** invades France (**Agincourt, 1415**). 1450. Jack Cade's rebellion. 1455–85. **Wars of the Roses** (Houses of **York** and **Lancaster** claim crown). 1485. **Henry VII** (**Tudor**) defeats Richard III (York) at Bosworth and ends war. Strong monarchy established.	1453. **Turks take Constantinople;** end of Eastern Empire. 1492. **Columbus discovers America.** 1492. Conquest of Granada; Moors expelled from Spain. 1497–98. **Vasco da Gama reaches India by sea.**
1500	**1515–47. Francis I;** wars with Charles V over Milan; Renaissance encouraged in France. **1562. Huguenot Wars begun** (St. Bartholomew's Massacre, 1572). **1589–1610. Henry IV** (**Bourbon**). Edict of Nantes ends Huguenot wars (1598).	1517. Luther begins **Protestant Reformation; Diet of Worms** condemns Luther (1521). **1519–56. Charles V rules Spain, Germany, Netherlands, parts of Italy and America.** Opposes Luther; wars against Turks (1526–32); abdicates (1555–56). **1555. Religious peace of Augsburg** (toleration of Lutherans). 1556–64. Ferdinand I. **1563. Council of Trent ends** (beginning of Catholic recovery).	1503–13. **Pope Julius II** (Italian wars; patron of Michelangelo and Raphael). 1508. League of Cambrai (Pope, Austria, France, and Spain) against Venice. 1513–21. **Pope Leo X** (Medici) patron of arts and letters. 1542. Pope Paul III establishes the Inquisition in Rome. 1571. League of Papacy, Spain and Venice against Turks (**Battle of Lepanto,** 1572).	**1509–47. Henry VIII; separation of English Church from Rome.** 1547–53. Edward VI. 1553–58. **Queen Mary** restores Catholic Church. **1558–1603. Elizabeth establishes Church of England.** Growth of sea power; industrial development. Elizabethan period of literature (**Shakespeare**). 1588. **Spanish Armada** destroyed.	1518. **Zwingli** begins Reformation in Switzerland. 1536. **Calvin** begins Reformation at Geneva. 1540. **Jesuit order** founded by Loyola. **1556–98. Philip II** succeeds his father Charles V in Spain, Italy, Netherlands, and the New World. 1568. **Revolt of Netherlands** against Spain; siege of Leyden (1574); Union of Utrecht (1579); declaration of independence by the Dutch (1581).
1600	1610–43. Louis XIII; political power of the Huguenots crushed. (**Richelieu** chief minister of the crown.) **1643–1715. Louis XIV;** numerous wars of conquest; extravagant court at **Versailles;** brilliant period of French literature. 1685. Edict of Nantes revoked and toleration of Huguenots ended.	**1618–48. Thirty Years' War.** Imperialist (Catholic) generals, **Tilly and Wallenstein; Gustavus Adolphus,** Protestant king of Sweden, victorious at **Leipzig** (1631); **Lützen** (1632); **Peace of Westphalia** (1648). 1640–88. **Growth of Prussia** under the **Great Elector.** 1683. **Vienna besieged for last time by Turks;** rescued by **King John Sobieski of Poland.**	1629. War over Mantua between Spain (which possessed Milan) and Austria. 1684. Venice joins Austria and Poland in attack on Turks; makes conquests in Morea.	**1603–25. James I** (Stuart); personal union of England and Scotland. 1607. Virginia colony founded (Jamestown). 1620. Plymouth colony settled (Boston, 1630) by Puritans fleeing persecution in England. **1642–49. Civil war** between Crown and Parliament; Marston Moor (1644); Naseby (1645). Charles I executed (1649). England a commonwealth. **1653–59. Cromwell rules** England, Scotland, and Ireland as Lord Protector. **1660. Stuart restoration** under Charles II. **1688. "Glorious Revolution"** expels James II and seats William and Mary; Protestant succession established.	1611–32. **Gustavus Adolphus** king of Sweden. 1644. Manchu rule begins in China. 1648. Spain recognizes independence of the Dutch Netherlands. **1672–1715. Peter the Great;** introduction of western culture in Russia; St. Petersburg founded (1703). **1697–1718. Charles XII of Sweden.**
1700	**1701–13. War of the Spanish Succession.** Treaty of Utrecht seats French prince (Philip V) on Spanish throne. **1715–74. Louis XV;** debauchery at court; France aids Prussia in Austrian Succession War. **1756–63. Seven Years' War;** France aids Austria against Prussia, loses Canada and India to British. **1774–92. Louis XVI** (Marie Antoinette of Austria, queen); reform measures defeated. **1789–95. French Revolution.** Estates-General becomes National Assembly (1789); constitution accepted by king (1791); kingship abolished (1792); **Louis XVI executed** (1793); **Reign of Terror** (1793-94); **Directory** established (1795). 1796–99. Rise of **Napoleon Bonaparte** to be First Consul.	1701. Elector of Brandenburg receives title of **King of Prussia.** 1701–13. Austria takes part in **War of Spanish Succession.** 1713–40. Frederick William I develops Prussian army. 1740–80. **Maria Theresa** queen of Bohemia and Hungary, archduchess of Austria; **War of Austrian Succession** (1740–48). **1740–86. Frederick II** (**The Great**) seizes Silesia from Austria and retains it in **Seven Years' War** (Battles of **Rossbach** and **Leuthen,** 1757); builds up Prussia in peace time. 1765–90. **Joseph II** emperor; attempts **reforms** in Hapsburg lands. 1790–92. Leopold II emperor.	1714. Milan, Naples, etc., given to Austria by treaty. 1715. Turks drive Venetians from the Morea and Crete. 1735. Spanish Bourbons established in Naples. 1738. Tuscany given to Francis of Lorraine (husband of Maria Theresa). 1796. **Napoleon** invades Italy; siege of Mantua. 1797. Cisalpine Republic set up by Bonaparte.	1701–13. England takes part in War of Spanish Succession (**Blenheim,** 1704). 1702–14. Anne queen. **1714. George I** (**Hanover**) **becomes king;** growth of cabinet government. 1741–48. England aids Austria in Austrian Succession War. 1745. Jacobite rebellion (Stuart supporters). **1756–63. Seven Years' War; England aids Prussia; Canada acquired;** supremacy established **in India; British Empire founded.** **1764. Industrial Revolution begun;** Hargreaves invents spinning jenny. **1775–83. Revolt of the American colonies.** 1788. British colonization of **Australia** begun.	1709. Battle of Pultowa; forces of Charles XII crushed by Russia. **1763–96. Catherine II** empress of Russia. **1772–95. Poland partitioned** among Russia, Prussia, and Austria.

WARS OF THE FRENCH REVOLUTION AND BONAPARTE—1792-1815

1796. Bonaparte's **Italian Campaign.**

1798. Egyptian expedition fails (Battle of the Nile).

1800. Napoleon's victory at Marengo.

1805. Nelson victorious at **Trafalgar.**

1805. Bonaparte wins at **Austerlitz.**

1806. Prussia crushed at **Jena.**

1807. Napoleon defeats Austrians at **Wagram** and Russians at **Friedland.**

1807. **Peace of Tilsit;** hard terms for Prussia. Alexander I of Russia becomes Napoleon's ally.

1812. **Napoleon invades Russia;** sack of Moscow; retreats with heavy losses.

1813. Napoleon defeated in three-day battle at **Leipzig.**

1815. Wellington victorious at **Waterloo.**

1815. Treaty of Vienna.

	FRANCE	GERMANY	AUSTRIA-HUNGARY	ITALY
1800	1804. **Napoleon made emperor.** 1814. **Napoleon** abdicates; returns from Elba (1815); **exiled** (1815). 1814. **Bourbons restored** under Louis XVIII. 1824–30. **Charles X**; reactionary policy. 1830. French begin occupation of Algeria. **1830. July Revolution**; Charles X abdicates; **Louis Philippe becomes king** ("citizen king"). 1840–48. Guizot ministry, conservative. **1848. February Revolution**; Louis Philippe abdicates; republic proclaimed. 1848–52. **Second Republic** (Louis Napoleon, president). 1851. Coup d'etat of Louis Napoleon; proclaimed emperor (**Napoleon III**, 1852–70). 1854–56. **Crimean War.** 1859. **War with Austria** in behalf of Italy. 1861–67. Attempt to found a monarchy in Mexico fails (Maximilian). **1870–71. Franco-Prussian War**; France loses **Alsace-Lorraine.** **1870. Third French Republic** proclaimed. 1875. Republican Constitution adopted. 1881. Tunis occupied; complications with Italy, Spain, and England. **1891. Dual Alliance** of France and Russia announced. 1894–1906. Trials of Dreyfus for treason center of political scandal. 1896. Annexation of Madagascar.	1806. **Confederation of the Rhine formed** by Napoleon. **1806. Holy Roman Empire dissolved.** 1819. **Carlsbad decrees** passed by German Diet suppress liberalism. 1833. German Customs Union (**Zollverein**) formed. 1840–61. **Frederick William IV** king of Prussia. 1848. Liberal uprisings in Prussia and other German states. 1848–49. **Frankfort Parliament** to unite Germany fails. 1861–88. **William I** king of Prussia. 1862. **Bismarck** becomes chief minister. 1864. **Schleswig** and **Holstein** seized by Prussia and Austria. 1866. **Austro-Prussian War.** 1867–71. **North German Confederation** under Prussian leadership. **1870–71. Franco-Prussian War**; siege of **Metz** and battle of **Sedan** (1870); capture of **Paris** (1871). **1871. German Empire** proclaimed; **William I** emperor; Bismarck chancellor (1871–90). **1882.** Germany enters **Triple Alliance.** 1884. Germany begins African colonization. 1888–1918. **William II** emperor. 1897. Germany seizes Kiaochow. 1899. Germany obtains Bagdad railway concession from Turkey; other powers refuse to participate in work; Great Britain begins obstructions. Growth of Turko-German friendship.	**1806. Holy Roman Empire dissolved**; Francis II becomes Francis I of Austria. 1809. **Metternich** becomes minister of foreign affairs; reactionary leader of Europe (1815–48). **1815. Congress of Vienna**; treaty of Vienna signed; **"Holy Alliance"** formed by Russia, Prussia, and Austria. 1835–48. Ferdinand I; reactionary rule. 1848. Revolution expels Metternich; liberal gains short-lived. **Francis Joseph I** begins long reign. 1849. **Hungarian** war for **independence** fails (**Kossuth**). **1859. War** with **France** and **Italy** (Battles of **Magenta** and **Solferino**). Austria loses Lombardy. 1866. **War** with **Prussia** (**Sadowa**). Austria withdraws from German Confederation and loses Venetia. **1867. Dual Monarchy** of **Austria-Hungary** established. 1876–90. Count Tisza, liberal leader, pursues policy of "Magyarization" in Hungary; economic development. **1882. Triple Alliance** formed by Austria, Germany, and Italy.	1815. Italy a group of small states under Austrian domination. 1820. **Revolt in Naples** put down. 1821. **Revolt in Sardinia-Piedmont** fails. 1830. **Revolution** in Italy **suppressed** by Austria. 1848. **Revolution** headed by Sardinia-Piedmont **crushed** by Austria. 1849. **Victor Emmanuel II** becomes king of Sardinia-Piedmont. **Cavour** premier (1852–61). 1859. **War with Austria**; Austrian control in Italy broken. 1860. **Garibaldi** conquers Naples. **1860–61. Italy** (except Rome) **united** under Victor Emmanuel; kingdom of Italy proclaimed (1861). **1870. Rome** taken from pope and made **capital** of Italian kingdom. 1878–1900. **Humbert I** (assassinated by anarchist). **1882.** Italy enters **Triple Alliance** with Austria and Germany. 1896. War with Abyssinia; fall of Crispi as prime minister.
1900	1904. **Entente Cordiale** between France and Great Britain settles disputes over colonies. 1905. **Separation of Church and State.** 1905–06. Extension of French influence in **Morocco** challenged by Germany; **Algeciras Conference** upholds French policy. 1911. Germany's attempt to protect its nationals during native uprising in Morocco reopens **Moroccan question.** Moroccan and Congo Conventions guarantee economic opportunities to Germany and Protectorate to France; part of French Equatorial Africa given to Germany.	1900. Great **naval development** begins. 1905–06. **First Moroccan incident.** 1908. Germany upholds Austria in **Bosnia affair.** 1911. **Second Moroccan incident.** 1911. **Enormous development** of Germany shown by: increase of population from 24 to 65 million since 1871; growth of foreign trade from 1,500 to 4,450 million dollars since 1875. 1911–13. German standing army increased from 515,000 to 866,000 men. 1912. Socialists elect 110 of 397 members of Reichstag.	1905–13. Struggle in Hungary over electoral reform; **Magyars** retain political control. 1907–12. Reform measures in Austria blocked by **racial quarrels.** 1908. Austria annexes **Bosnia** and **Herzegovina**; blow to Serbian nationalist movement. **1914. Archduke Francis Ferdinand,** heir to Austrian throne, **assassinated** in Bosnia by subjects of Serbian blood.	**1900. Victor Emmanuel III** becomes king. **1911–12. War with Turkey;** Italy takes **Tripoli** from Turkey. 1912. **Universal suffrage** introduced.

WORLD WAR

1914. Aug. 1. **Germany declares war** on Russia and World War begins.
1914. Sept. 6-10. **Battle of Marne** halts German invasion of France and Belgium.
1915. **Gallipoli expedition** fails.
1915. **Italy and Bulgaria** enter the war.
1916. Germans fail to take **Verdun**; first **battle** of the **Somme.**
1917. Apr. 6. United States enters the war.

FRANCE	GERMANY	AUSTRIA-HUNGARY	ITALY
1919. Treaty of Versailles ratified. By this and subsequent peace treaties France obtains **Alsace-Lorraine,** parts of **Cameroon** and **Togo** (in Africa), mandate over **Syria,** etc., also economic reparations.	1918. **German revolution; William II abdicates.** 1919. June 28. **Treaty of Versailles** signed (ratified July 10); Germany loses overseas colonies; **Alsace-Lorraine,** parts of **Posen** and **West Prussia,** etc., armament reduced; reparations provided for. 1919. **"Spartacan"** (extreme Socialist) **revolt** suppressed. 1919. **Republican constitution** adopted.	1916. **Charles I** succeeds Francis Joseph. 1918. Oct. 21. Independence of **Czecho-Slovakia** proclaimed. 1918. Nov. 3. Austria signs **armistice.** 1918. Oct. 31. **Hungary** declares itself an independent **republic.** 1918. Nov. 12. **Republic of Austria** proclaimed; Charles I abdicates.	1919. **Treaty of St. Germain;** Italy gains **Trentino,** etc. 1919–20. **D'Annunzio** holds **Fiume.**

FRANCE	GERMANY	CZECHO-SLOVAKIA	HUNGARY	AUSTRIA	ITALY
1920. Caillaux's trial for treason concluded, a feature in political life. 1920. **Clemenceau** resigns as premier. M. Millerand appointed successor. 1920. French troops occupy **Frankfort** but withdraw upon protest of British government. 1920. Chamber of Deputies votes to resume diplomatic relations with Vatican. 1920. Millerand elected president. 1921. Briand appointed premier and minister of foreign affairs. 1922. **Poincare premier**; declares policy of insisting on all France's rights under the Treaty of Versailles. 1923. French troops seize the rich industrial region of the **Ruhr.**	1920. **Upper Schleswig** votes for union with Denmark. 1920. Kapp counter-revolution fails. 1920. German delegates admitted to meeting of Supreme Council at Spa. 1921. **Upper Silesia** plebiscite returns majority for German union. 1921. Amount of **reparations** fixed at 132 billion gold marks. 1923. Reparations Commission holds Germany in default on treaty obligations; **Ruhr occupied** by French and Belgian troops.	1920. **Constitution** adopted. 1920. Joins Jugo-Slavia and Rumania in **Little Entente** against Hungary.	1919. Mar.-Aug. Soviet régime overthrown with Rumanian aid. 1920. **Treaty of Trianon;** Hungary loses territory to Czecho-Slovakia, Italy, etc. 1921. Attempt of Charles I to regain throne fails; Charles exiled to Madeira.	1919. **Treaty of St. Germain** reduces Austria to small area about Vienna. 1920. **Klagenfurt region** votes for union with Austria. 1921. Various districts vote for union with Germany.	1920. **Treaty of Rapallo** with Jugo-Slavia secures **Istria** and **Gorizia; Fiume** free state. 1921. Struggle between Fascisti and communists for political control. 1922. Fascisti get control of government by a "bloodless revolution;" **Mussolini,** their leader, becomes **Prime Minister.**

ERN HISTORY — (Concluded)

GREAT BRITAIN

1801. **Irish Parliament abolished;** Irish members seated in British Parliament. **United Kingdom** of Great Britain and Ireland.
1806. **Cape Colony** conquered; beginning of British in South Africa.
1807. **Abolition of slave trade** in British Dominions.
1812–14. **War with the United States; Treaty** of Ghent (1814).
1820–30. **George IV** king.
1827. English fleet participates in battle of **Navarino Bay** against Turks.
1830–37. **William IV** king.
1832. Reform Bill; political power to middle classes. Other legislation abolishing slavery, reforming labor conditions, etc.
1837. Victoria begins her long reign.
1846. Repeal of corn laws; **free trade** established.
1854–56. Crimean War with Russia in defense of Turkey.
1857. **Indian Mutiny; British government assumes rule of India** (1858).
1867. Second parliamentary reform act; **political power** extended **to workingmen;** beginning of **democratic rule.**
1868–74. First ministry of **Gladstone** (Liberal); "Great Ministry."
1870. Beginning of **Home Rule** agitation.
1874–80. **Disraeli** ministry (Conservative).
1882. British occupy **Egypt.**
1887. First Colonial Conference.
1899–1902. **Boer War. Union of South Africa** formed (**1909**).

1901. Queen Victoria dies.
1901–1910. **Edward VII** king.
1901. **Commonwealth of Australia** formed.
1903. Irish land purchase act passed.
1907. **Anglo-Russian Agreement** settles differences over **Persia.**
1908–1916. **Herbert Asquith** prime minister (Liberal).
1910. **George V** king.
1911. **Power of House of Lords limited.**
1914. **Irish Home Rule Bill** passed and suspended.
1914. Bill passed for **disestablishing Anglican Church of Wales;** suspended.

RUSSIA

1801–25. **Alexander I** emperor.
1809. **Finland** ceded to Russia following war with Sweden (1807–09).
1815. Czar grants a constitution to Poland.
1825–55. **Nicholas I** emperor.
1828–29. Russia wages **war against Turkey** in behalf of Greece.
1830–32. Revolution in Poland fails; **Poland** made a **Russian province.**
1854–56. **Crimean War;** western powers against Russia (siege of **Sebastopol,** 1854–55). Peace of Paris formulates rules for naval warfare (1856).
1855–81. **Alexander II** emperor.
1861. Czar **frees Russian serfs.**
1863. **Polish insurrection** suppressed vigorously.
1877–78. Russo-Turkish War.
1881. Alexander II assassinated.
1881–94. **Alexander III** pursues strong **reactionary** policy. Persecution of Jews begins.
1891. Dual Alliance formed.
1894–1917. **Nicholas II** exercises **absolutism;** suppression of intellectual progress.
1899. Finnish constitution abrogated.

1902. **Trans-Siberian railroad** opened.
1904–05. Russo-Japanese War.
1905. Russian revolution begins; first **Duma** meets (1906).
1907. **Anglo-Russian agreement** made.

TURKEY AND THE BALKANS

1821–29. **War for Greek independence** (Philhellenic movement; Lord Byron). Greece gains independence (1829).
1828–29. **Russo-Turkish War** (Treaty of **Adrianople;** Greek Independence acknowledged; **Moldavia** and **Wallachia** partially independent).
1830. **Serbia** secures **autonomy** after long struggle (revolts of 1804, 1820).
1833–62. **Otto I** (House of Bavaria) king of Greece.
1854–56. Crimean War. Western Powers aid Turkey against Russia.
1866. **Rumania formed** as self-governing state by union of Moldavia and Wallachia (Charles I, 1866–1914).
1877–78. Russo-Turkish War (siege of **Plevna,** 1877). **Treaties of San Stefano** and **Berlin** make Serbia, Montenegro, and Rumania independent; Bulgaria partly autonomous.

1908–09. Successful **revolution in Turkey** by **"Young Turks."**
1911–12. **Turco-Italian War.**
1912–13. **Balkan Wars;** Balkan allies conquer most of Turkey in Europe; fight over new boundaries.

OTHER COUNTRIES AND GENERAL PROGRESS

Application of steam power, by James Watt, to spinning and weaving industries leads to **industrial revolution.** 19th century opens new era.
1807. **Steamboat** service established by **Fulton.**
1812. **Uprising in Spain** against **Napoleon** and adoption of Liberal Constitution. **Liberalism** later **suppressed** by Ferdinand VII (1814–33).
1820. Revolutions in Italy and Spain crushed by European Alliance (1821–23).
1830. **Revolutionary movements** in **Italy, Poland,** and **Belgium.** Independent **monarchy** established in **Belgium** (**Leopold I,** 1833–65).
1830. Manchester and Liverpool **railroad opened;** Baltimore and Ohio railroad begun.
1837. Patent granted to S. F. B. **Morse** for electro-magnetic **telegraph.**
1840. British **"opium war"; China opened** to foreigners.
1854. **Japanese ports opened** to foreigners.
1858. **Trans-Atlantic** telegraph **cable** laid (permanent from 1866).
1859. Publication of Charles **Darwin's** 'Origin of Species' setting forth doctrine of evolution.
1864. Geneva Convention; beginning of **International Red Cross.**
1869. **Suez Canal** opened.
1883. Congo Free State formed, Leopold I of Belgium king; made Belgian colony (1908).
1884. Partition of Africa among European powers.
1894–95. War between China and Japan. **Expansion of Japan** begins.
1899. First Hague Peace Conference. Establishment of Court of International Arbitration.
1899. **Wireless telegraphy** established between France and England by **Marconi** (Italian).

1900. European Powers intervene in **Boxer Uprising** against foreigners in China.
1903. First successful demonstration of **airplane** by Wright brothers at Kitty Hawk, N. C.
1905. **Union of Sweden and Norway dissolved.**
1907. Nineteen women elected to Finnish Diet, **first women** members in a **national legislature.**
1907. Second Peace Conference at The Hague.
1909. Commander **Peary** reaches **North Pole.**
1910. **Revolution** in **Portugal; republic** established.
1911–12. **Revolution** in **China; republic** proclaimed.
1911. Capt. Roald **Amundsen** reaches **South Pole.**
1914. **Panama Canal opened** to traffic by U. S.

OF 1914–1918

1917. Jerusalem captured by the British.
1918. Russia (Mar. 3) and **Rumania** (May 6) sign **peace** with Central Powers.
1918. Mar. 21–July 18. **German drive** in the West **fails.**
1918. July 18–Nov. 11. **Allied counter-offensive successful; Hindenburg line smashed.**
1918. Armistices signed by **Bulgaria** (Sept. 30), **Turkey** (Oct. 30), **Austria** (Nov. 3), **Germany** (Nov. 11).

1916. **Sinn Fein revolt** in Ireland crushed; **Sir Roger Casement** executed.
1916. **Lloyd George** becomes premier (Coalition Cabinet).
1918. **Suffrage** extended to **women.**
1918. Labor party secures 75 seats in Parliament at general elections.
1919. **Anglo-Persian agreement** puts Persia under British influence.
1919. **Irish declare independence;** movement for republic checked by military measures; rioting and disorder follow.
1919. By the **Treaty of Versailles** and subsequent agreements Great Britain obtains **mandates** over much former German territory in **South Africa, Palestine, Mesopotamia,** etc.
1920. New Home Rule Bill passed.
1920. Labor unrest leads to adoption of liberal government labor program.
1921. King opens the **Ulster Parliament** under Home Rule Bill.
1921. Truce between Sinn Feiners and government; treaty negotiated giving Ireland dominion **status** in British Empire.
1922. **Irish Free State** inaugurated.
1922. Coalition government falls; **Bonar Law** (Unionist) becomes Prime Minister.
1923. Stanley Baldwin (Conservative) becomes Prime Minister.
1923. De Valera calls off armed resistance in Ireland.

POLAND

1917. **Poles** organize army and **join Allies.**
1918. **Republic of Poland proclaimed.**
1919. **Treaty of Versailles** recognizes Polish independence and restores German, Austrian, and part of Russian Poland.
1921. **Treaty** of peace with Russia.
1921. **Constitution** adopted.
1921. Plebiscite in **Upper Silesia** gives Germany largest vote, but Poland important districts; disorder follows.
1922. President Narutowicz assassinated.

1917. Mar. 15. **Revolution; Nicholas II abdicates; Kerensky** becomes dictator. **Republic proclaimed,** Sept. 17.
1917. Nov. **Bolshevik** government succeeds Kerensky régime.
1918. Mar. 3. **Peace of Brest-Litovsk** signed with Germany.
1917–18. Several Russian provinces establish independence: **Finland, Ukraine, Esthonia, Lithuania, Latvia.**
1919–20. Anti-Bolshevik leaders overthrown; influence extended into Asia Minor.
1921. **Russo-Polish treaty.** Russia retains White Russia.

1917. **Greece joins Allies** following abdication of Constantine I.
1918. Kingdom of Serbs, Croats, and Slovenes **(Jugo-Slavia) proclaimed.**
1919–20. **Greece** obtains **Thrace, Smyrna,** etc., by **treaties** of **Neuilly** and **Sèvres.**
1920. **Turkey** loses half her population and two-thirds of her territory by **Treaty of Sèvres; Smyrna** to Greece, **Adana** to Italy, **Syria** a French mandatary, **Palestine** and **Mesopotamia** British mandataries, **Armenia** independent republic, Straits internationalized.
1920. Alexander dies; **Constantine recalled** to Greece by popular vote.
1921. War between Greeks and Turkish Nationalists in Asia Minor; Greece rejects Allied offers of settlement and demand to return Smyrna to Turkey.
1922. **Turkish Nationalists** sweep Greek forces out of Asia Minor and force allies to restore **Eastern Thrace;** dethrone Sultan and decree **end of Ottoman Empire.**
1922. King Constantine of Greece forced to abdicate; **Prince George succeeds** to throne; six high officials executed as traitors.
1923. Treaty of **Lausanne** revises Treaty of Sèvres and establishes peace in Near East.

1919. International labor conference in Washington.
1920. **Rumania** obtains **Bessarabia** by treaty with Great Powers.
1920. **Armenia overrun** by Bolsheviki and Turks. President Wilson appoints a mediator.
1920. League of Nations established; first meeting of Council in Paris, Jan. 16; Assembly meets in Geneva, Nov. 15.
1920. **Danzig** and **Saar Valley** put under administration of League of Nations.
1921. Turkish Nationalists occupy Teheran.
1921. Limitation of Armament Conference at Washington.
1922. Japanese forces **evacuate Siberia.**
1922. British end **protectorate over Egypt.**
1922. Permanent Court of International Justice opened at The Hague.
1922. Scientists at the University of Chicago announce that they have transmuted other elements into helium.
1923. American troops on the **Rhine** ordered home.
1923. Earthquake in Japan; Tokyo and Yokohama laid in ruins; 300,000 lives lost.
1923. Military directorate assumes control in Spain.

III. THE WORLD WAR AND THE PEACE SETTLEMENT—1914-19

PRELIMINARY EVENTS

1914

June 28. Archduke Ferdinand assassinated.
July 23. Austria sends ultimatum to Serbia; conciliatory reply (July 25).
July 27. Failure of conference proposed by England owing to refusal of Germany.
July 28. Austria declares war on Serbia.
July 29. Russia mobilizes against Austria in aid of Serbia.
July 30. Belgrade bombarded. General mobilization in Russia begun.
Aug. 1. Germany declares war on Russia over mobilization.
Aug. 2. Germany demands passage through Belgium.
Aug. 3. Germany declares war against France, Russia's ally.
Aug. 4. Germans invade Belgium when passage is refused.
Aug. 4. England declares war on Germany to protect Belgium.

	WESTERN FRONT	EASTERN FRONT	OTHER FRONTS AND EVENTS	DIPLOMATIC EVENTS
1914	**Sept. 6-10. German invasion of France stopped at the Marne.** Entrenched line established along the Aisne, north to Belgian coast, and southeast to Switzerland. Oct.-Nov. Germans fail to break line in **Flanders** (Ypres).	Aug. 26-31. Hindenburg stops Russian offensive at **Mazurian Lakes** (Battle of Tannenberg). Aug.-May, 1915. Russians invade **Galicia** and capture Carpathian passes. Nov.-Dec. Three German attacks on **Warsaw** beaten off.	Aug. 24. Naval battle at Helgoland; **German navy bottled up.** Aug.-Sept. Germany loses oversea colonies—in Africa to the British, Pacific Islands to British and Japanese. Aug.-Sept. Austrian invasions of **Serbia** fail. Nov. 6. **Japanese take Tsingtau (Kiaochow)** in Shantung, China, from Germans. Nov. 10. German cruiser **Emden** destroyed at Cocos Islands.	Aug. 7. **Montenegro** joins the Allies. Aug. 23. **Japan** joins the Allies. Oct. 29. **Turkey** openly joins Germany and Austria.
1915	Repeated attempts to break the line by Allies at **Neuve-Chapelle** (Mar. 10); Germans at **Ypres** (Apr.-May); Allies above **Arras** (May-June); Germans in the **Argonne** (July); Allies in **Champagne** and **Artois** (Sept.-Oct.).	May-Sept. **"Mackensen's drive"** expels Russians from Galicia. June-Oct. **Austro-German drive into Russian Poland;** capture of **Warsaw** (Aug. 5); Brest-Litovsk (Aug. 25); Vilna (Sept. 18).	Feb.-Dec. Anglo-French attacks on the **Dardanelles** fail. May 7. **Lusitania** sunk; 1,198 lives lost. July. German Southwest Africa conquered by General Botha. Oct.-Dec. **Austro-German army conquers Serbia;** Allied expedition from Saloniki defeated at Vardar (Dec. 3-12). Dec.-Jan. **Gallipoli** expedition abandoned by Allies after enormous losses.	May. 23. **Italy declares war** on Austria. Oct. 13. **Bulgaria** joins Teutonic allies.
1916	Feb.-July. **Terrific German attacks on Verdun fail** ("They shall not pass"). July-Nov. Allied gains in **Battle of the Somme.**	June-Aug. Russian counter-attack on **Galicia;** penetrates to Halicz. Aug.-Dec. **Rumania invades Transylvania;** terrific **counter-attack** of German-Austrian-Bulgarian armies (Mackensen); **Bucharest taken and Rumania crushed.**	Jan.-Feb. Austro-Bulgarian invasion of **Montenegro** and **Albania.** Jan.-July. Russian drive through the **Caucasus.** Apr. 25-28. Sinn Fein rebellion in Ireland crushed; Sir Roger Casement executed. Apr. 29. Capture of British forces at **Kut-el-Amara.** May-June. **Austrian offensive against Italy.** May 31. **Naval battle of Jutland;** German fleet withdraws. Aug. 4. **Italian counter-offensive** begun; gains in the Trentino; **Gorizia** captured (Aug. 9).	Mar. 9. **Portugal** joins the Allies. Aug. 27. **Rumania** joins the Allies. Dec. 7. Lloyd George displaces Asquith as head of British Cabinet.
1917	Mar. **Withdrawal of Germans to "Hindenburg line";** wasting of country on 50-mile front. Apr.-Dec. Repeated **Allied attempts to break line** at **Arras** (Apr.-June); **Vimy Ridge** taken (Apr. 9-12); along **Aisne** (Apr.-Nov.); in **Flanders** (July-Dec.); at **Cambrai** (Nov.-Dec.).	Mar. 15. **Russian revolution** destroys effectiveness of Russian army. July. Russian offensive on east front fails. Sept. 3. **Riga** captured by Germans.	Feb.-Oct. British Mesopotamia campaign; **Kut-el-Amara recaptured** (Feb. 24); **Bagdad** (Mar. 10). Oct.-Dec. **Italian disaster at Caporetto;** driven back from Isonzo to Piave. Oct.-Dec. Allenby's Palestine campaign; **fall of Jerusalem** (Dec. 10).	Jan. 31. **Germany announces unrestricted submarine warfare.** Feb. 3. **United States** severs diplomatic relations with Germany. Mar. 15. **Czar of Russia dethroned;** Kerensky establishes moderate government. **Apr. 6. United States enters the war;** Panama, Cuba, Liberia, Brazil follow; nine Central and South American states sever relations with Germany but do not declare war. June 12. King Constantine deposed and **Greece joins Allies.** Aug. 14. **China** joins the Allies. Nov. 8. **Bolsheviki** control government in Russia.
1918	**Mar.-July. Great drive of Germans fails:** Picardy offensive launched (Mar. 21); Lys River (Apr. 9); Aisne and Marne (May 27); Oise (June 9); second battle of the Marne (July 15). **July 18. Allied counter-offensive begun:** Second battle of the Somme (Aug. 8); Americans take **St. Mihiel** (Sept. 12); Germans lose Lys salient (Aug.-Sept.); **Allied and American advance along Argonne-Meuse front** (Sept.-Nov.); **"Hindenburg line" broken** (Oct.); German right flank turned in Belgium (Sept.-Nov.); and line of retreat threatened. **Germans decide to surrender to avoid crushing defeat.**	Feb.-Mar. **Germany transports forces from Russian front** for use on western front. Sept. Allies defeat Bulgarian armies in Macedonia, and **Bulgaria sues for peace.** Oct.-Nov. **Montenegro** and **Serbia** recovered by Allies.	Aug. 4. Allies seize **Archangel,** Russia, and establish a northern front. Aug. American-Japanese expedition to **Siberia.** Sept. 19-Oct. 26. Allenby clears **Palestine** of Turks; cuts Bagdad railroad. **Turkey sues for peace.** Oct. 24-25. **New Italian attack drives Austrians back** on line from Alps to Adriatic. **Austria sues for peace** (Oct. 29). Nov. 14. Surrender of **German East Africa.**	Jan. 5. Lloyd George announces war aims of the Allies. Jan. 8. **President Wilson lays down "14 points."** Jan.-Feb. Breakup of Russia; Finland, Lithuania, Ukraine, Crimea, Armenia, Siberia, etc., set up independent governments. Mar. 3. **Soviet Russia concludes humiliating peace of Brest-Litovsk with Germany.** June 30-Sept. Allies recognize independence of **Czecho-Slovakia.** Sept. 30. **Bulgaria signs armistice.** Oct. 5. Germany appeals to President Wilson for restoration of peace. Oct. 30. Turkey signs armistice. Oct. 31. Hungarian independence declared. Nov. 3. **Austria signs armistice.** Nov. 9. Polish republic announced. Nov. 10. German Emperor flees to Holland; signs abdication (Nov. 28). Nov. 11. **Armistice signed by Germany.** Nov. 12. **Emperor Charles abdicates** Austrian throne. Nov. Jugo-Slav convention proclaims Unitary Kingdom of Serbs, Croats, and Slovenes.

THE PEACE SETTLEMENT

1919

Jan. 18. **Peace Conference** of 27 Allied and Associated Powers **meets at Versailles.** Treaties drawn up with five enemy nations.

June 28. **Treaty with Germany** signed at **Versailles;** includes **Covenant of the League of Nations.** Germany loses her overseas colonies, Alsace-Lorraine, parts of Posen and West Prussia, and lesser European territories; armament reduced: reparations settlement undertaken. Ratified by all the Powers except the United States, whose Senate rejects the treaty on Nov. 19, 1919, and Mar. 19, 1920.

Sept. 10. **Treaty with Austria** signed at **St. Germain.** Austria reduced from 115,000 to 32,000 square miles, and from 30,000,000 to 6,500,000 population, by territorial cessions to Czecho-Slovakia, Hungary, Poland, Rumania, Serbia, and Italy.

Nov. 27. **Treaty with Bulgaria** signed at **Neuilly.** Bulgaria loses her conquests of the Balkan Wars of 1912-13 and of the World War to Rumania, Serbia, and Greece.

1920

June 4. **Treaty with Hungary** signed at **Trianon.** Hungarian boundaries established with territorial concessions to Rumania, Jugo-Slavia, and other border states.

Aug. 10. **Treaty with Turkey** signed at **Sevres.** Turkey loses half her population and two-thirds of her territory; the Straits internationalized; much of Asiatic Turkey distributed among the Powers as mandataries; Armenia made an independent nation.

IV. CANADIAN HISTORY

	PERIOD OF DISCOVERY—1000-1500	OTHER COUNTRIES
1000	1000. **Northmen discover America.** 1497. **John Cabot discovers Newfoundland.**	
	FRENCH RULE	
1500	1534. **Cartier** coasts along Newfoundland; **explores the St. Lawrence** (1535, 1540).	1515–47. Francis I king of France. 1539–43. **De Soto's expedition** in southern United States. 1555–64. Coligny attempts to found Huguenot colony in Florida.
1600	1604. **Port Royal** (Annapolis, Nova Scotia), first permanent French settlement, founded. 1608. **Quebec settled** by French colonists led by **Champlain.** 1610. **Hudson discovers Hudson Bay** while searching for the Northwest Passage; England claims Hudson Bay region. 1613. **English colonists** from Virginia **capture Port Royal; Quebec** captured by the British (1629); New France and Acadia restored to the French by the treaty of St. Germain (1632). 1615. **Champlain explores Lake Huron.** 1623–32. War between English and French. English attack Acadia (Nova Scotia); capture Quebec. Canada restored to France by treaty. 1627. St. Lawrence valley granted to Richelieu's company of **"One Hundred Associates"**; control New France (1627–63). 1642. **Montreal founded** by Maisonneuve as a religious colony. 1658–60. **Groseillers** and **Radisson** reach the Mississippi and Great Plains. 1663. Charter of the company of "One Hundred Associates" revoked; **New France a royal colony.** 1666. **Allouez** founds a mission on Lake Superior. 1670. **Hudson's Bay Company founded** in England to carry on trade in the new territory. 1672. **Frontenac** becomes governor of Canada. 1673. **Marquette and Joliet discover the Mississippi.** 1682. **La Salle descends the Mississippi** and takes the country for France. 1689–97. **"King William's War"; Acadia captured** by the British; attack on Quebec fails; conquest restored at the Peace of Ryswick (1697).	1607. **Jamestown,** Virginia, **settled** by English colonists. 1618–48. **Thirty Years' War** in Europe. 1620. **Plymouth Colony** founded by English Puritans. 1643–1715. Louis XIV king of France. 1688. William III of Orange ascends English throne. 1689–97. War of Louis XIV over succession in the Rhenish Palatinate. 1699. French settle in Louisiana.
1700	1701. **Detroit** founded as French post; **Forts Frontenac** and **Duquesne,** and other posts on the British frontier follow. 1701–13. **"Queen Anne's War."** Unsuccessful attack on Quebec; **Acadia seized; France cedes Hudson Bay region, Newfoundland, and Acadia to Great Britain** (Treaty of Utrecht, 1713). 1743. The **Verendryans** reach the foothills of the Rocky Mountains. 1744–48. **"King George's War." Louisburg** captured by English colonists (1745); restored to French by treaty of Aix-la-Chapelle. 1749. English settlement of **Halifax founded;** colonization of Nova Scotia begins. 1755–63. **"French and Indian War."** French deported from Nova Scotia (1755); British under **Wolfe capture Quebec** (1759); **New France ceded to England** by Peace of Paris (1763).	1701–13. **War of the Spanish Succession** in Europe. 1702–14. Anne queen of England. 1727–1760. George II king of England. 1741–48. **War of the Austrian Succession.** 1756–63. **Seven Years' War** in Europe.
	ENGLISH PERIOD	
	1774. **Quebec Act** passed by British Parliament to organize government for Canada. 1775–83. **American Revolution;** Loyalists flee to Canada; colonists' attack on Quebec repulsed. 1791. Canada divided into **Upper** and **Lower Provinces** by the **Constitutional Act** passed by British Parliament; popular assemblies established with limited powers. 1793. **Sir Alexander Mackenzie** reaches the Pacific Ocean.	1789–95. **French Revolution.** 1792–1815. Wars of the French Revolution and Napoleon.
1800	1812–15. **War with the United States;** American attempts to invade Canada repulsed; surrender of **Detroit** (1812); naval **battle of Lake Erie** (1813). 1812–20. Earl of **Selkirk** founds settlement in Red River Valley. 1837–38. **Rebellions** against officialdom; French Canadians led by **Papineau** attempt to found a republic in lower Canada; **William L. Mackenzie** heads armed rebellion in Upper Canada. 1838. **Lord Durham** sent out from England to determine conditions in Canada; famous report to colonial office leads to changes in Canadian policy. 1840. **Act of Union** joins the two provinces under a royal governor. 1842. Webster-Ashburton treaty between Great Britain and United States settles Maine boundary dispute. 1854. Reciprocity treaty with the United States; abrogated by United States (1866). 1858. Capital removed to **Ottawa.** 1864. **Quebec Conference** held to consider question of confederation.	1803. United States buys Louisiana territory from France. 1832. Parliamentary **Reform Act** passed by the British Parliament. 1837. Victoria ascends the British throne. 1846. Boundary between the United States and Canada settled at 49th parallel. 1861–65. **Civil War** in the United States.
	DOMINION PERIOD	
	1867. **British North America Act** establishes the **Dominion of Canada** (Confederation of Ontario, Quebec, New Brunswick, Nova Scotia), with self-government. 1867. Conservative government organized by **Sir John Macdonald** (premier 1867–73, 1878–91). 1869. Hudson's Bay Company's land purchased by Canadian government. 1870. **Rebellion of Red River** half-breeds against extension of Dominion control over Manitoba; led by **Louis Riel.** Province of **Manitoba** formed. 1871. Treaty of Washington between Great Britain and the United States provides for the settlement of the Nova Scotia fisheries dispute and the Oregon boundary question. 1871. **British Columbia joins the Union.** 1872. Anti-Unionist agitation in Nova Scotia ended by defeat of the party in general elections. 1873. **Prince Edward Island admitted** to the Union. 1873. Conservative government overthrown because of Canadian Pacific Railroad scandal; **Alexander Mackenzie** forms Liberal government. 1878. Conservatives restored on protectionist platform. 1885. **Riel** leads half-breed rebellion in Saskatchewan to obtain squatter rights. 1885. **Canadian Pacific Railroad finished.** 1893. Bering Sea controversy with the United States settled. 1896. Conservatives defeated on question of reëstablishment of Roman Catholic schools in Manitoba. 1896–1911. **Sir Wilfrid Laurier** premier (Liberal).	1866. Atlantic cable laid. 1870–71. **Franco-Prussian War.** 1887. **First British Colonial Conference.** 1899–1902. **Boer War** in South Africa.
1900	1903. Alaskan boundary dispute settled. 1905. **Alberta** and **Saskatchewan** organized as provinces. 1911. Liberals defeated on the question of reciprocity with the United States. 1911–20. **Sir Robert Borden** premier (Conservative). 1914–18. World War (*see* separate outline). 1917. **Unionist government** of Conservatives and Liberals formed to secure support for conscription. 1917. Laurier defeated on anti-conscription platform at general elections. 1919. Labor unrest expressed in severe general strike in Winnipeg. 1920. National Liberal and Conservative government formed; **Arthur Meighen** premier 1921. Liberals win in general elections; W. L. Mackenzie King premier.	1901. Commonwealth of Australia formed 1914. Panama Canal opened. 1918. Suffrage extended to women in Great Britain.

V. AMERICAN HISTORY—COLONIAL AND REVOLUTION

PERIOD OF DISCOVERY—1000-1600

1000

1000. Leif the Lucky (**Northman**) **discovers America.**
1492. **Columbus discovers America.**
1497. **John Cabot discovers Newfoundland,** etc.
1519. **Ponce de Leon discovers Florida.**
1513. **Pacific Ocean discovered by Balboa.**
1519–21. **Conquest of Mexico by Cortez.**
1528–36. **Narvaez** and **De Vaca explore** the **Gulf Region.**
1534–43. **Cartier discovers** and explores the **St. Lawrence.**

FOUNDING OF THE THIRTEEN COLO

1600

VIRGINIA

1607. **Jamestown founded** (first permanent English settlement). Captain **John Smith.**
1611–16. "Dale's Rule."
1619. House of Burgesses meets (**first representative assembly in America**).
1619. First **negro slaves introduced.**
1624. **Virginia** becomes a royal colony.
1642. **Berkeley** becomes governor.
1652–58. **Self-government** under the Protectorate.
1676. **Bacon's rebellion.**
1693. William and Mary College founded.
1710–22. Spotswood governor.

MARYLAND

1632. **Maryland granted to Lord Baltimore.**
1634. **St. Mary's** settled by English Catholics.
1647. **Representative assembly established.**
1649. **Act of toleration** for all Christians passed.
1691. **Maryland** becomes **a crown colony.**
1729. **Baltimore** founded.

NEW YORK

1609. **Hudson discovers** the **Hudson River.**
1614. **Dutch trading post established** on Manhattan Island.
1626. **New Amsterdam** founded.
1629. Patroon system organized.
1638. **Swedes settle** along the **Delaware.**
1655. Dutch seize Swedish colony.
1664. **New Amsterdam** captured by English fleet; **becomes New York.**
1683. **First assembly** in New York.
1688. New York united to New England under Andros.

NEW JERSEY

1664. **New Jersey granted** to **Berkeley and Carteret.**
1674. Colony divided into East and West Jersey.
1682. Penn purchases East Jersey.
1702. **Two Jerseys reunited as a royal province.**

DELAWARE

1623–64. **Dutch** and **Swedes** settle west side of Delaware Bay and River.
1682. **Delaware** included in Penn's grant.
1703. **Delaware** becomes **a separate colony.**

1700

MASSACHUSETTS

1620. **Pilgrims land at Plymouth.** (**'Mayflower'** voyage.)
1623. **New Hampshire settled** at Dover.
1630. **Boston** (Massachusetts Bay Colony) **founded.**
1636. **Roger Williams** expelled from Salem.
1638. **Harvard College** founded.
1643. **New England Confederation** formed.
1645. Free school at Roxbury.
1652. Massachusetts extends control over Maine.
1675. **King Philip's War** in New England; Indian uprising against settlers suppressed.
1684. Massachusetts charter annulled.
1686. **Andros** becomes **governor** of New England.
1691. **Plymouth unites with Massachusetts.**
1692. Salem **witchcraft** cases.

NEW HAMPSHIRE

1680. **New Hampshire separates** from Massachusetts.

RHODE ISLAND

1636. **Roger Williams** founds **Providence.**
1638. **Newport** settled.
1663. **Rhode Island** obtains a **charter.**

CONNECTICUT

1635. **Hartford, Windsor,** etc., settled.
1637. **Pequot War.**
1638. **New Haven** founded.
1662. **Charter** granted to **Connecticut.**

STRUGGLE BETWEEN FRANCE AND GREAT BRITAIN FOR SUPREMACY IN

1689–97. King William's War: New England colonists under Sir William Phips seize **Port Royal, Acadia;** attack on Quebec fails; Peace of Ryswick restores conquests on each side (1797).
1701–13. Queen Anne's War: frontier raids by French and Indians (**Deerfield,** 1704; **Haverhill,** 1708); English capture **Port Royal;** expedition against Quebec unsuccessful. **France cedes Hudson Bay region, Newfoundland,** and **Nova Scotia** (Acadia) to **Great Britain** (Treaty of Utrecht, 1713).
1744–48. King George's War: Colonists capture **Louisburg** (1745); restored to France by Treaty of Aix-la-Chapelle (1748).
1755–63. French and Indian War: expedition against Fort Duquesne fails (Bur-

CONFLICT BETWEEN COLONIES AND PARLIAMENT—

1763. British ministry adopts rigid colonial policy; **Navigation Acts** restricting colonial commerce to England strictly enforced; renewal of Sugar Act taxing importations from foreign colonies.
1764. **Stamp Act** resisted in the colonies. **Virginia resolutions** (1765); **Stamp Act Congress** protests against colonial policy (1765); Act repealed.
1767. **"Townshend Acts"** to enforce trade laws and taxing tea, paper, etc. Boston riot (1770); Boston Tea Party (1773).

REVOLUTIONARY WAR—1775-1783

1775. Skirmishes at **Lexington** and **Concord;** Capture of **Ticonderoga** and **Crown Point;** Battle of **Bunker Hill.**
1775. Second Continental Congress meets.
1776. British **evacuate Boston;** naval attack on Charlestown fails.
1776. July 4. Declaration of Independence adopted.
1776–77. **Washington retreats** across New York and New Jersey (Battles of **Long Island, White Plains, Trenton,** and **Princeton**).
1777. British attempt to cut the colonies in two: **Burgoyne's** and **St. Leger's campaign** from Canada **fails** (**Oriskany, Bennington, Saratoga**). **Howe's campaign** against Washington (Battle of **Brandywine,** occupation of **Philadelphia, Germantown**).
1777. Congress adopts **Articles of Confederation** (ratified by states, 1777–81).
1777–78. Washington winters at **Valley Forge.**
1778. **France recognizes independence of the colonies;** arrival of French army under **Rochambeau.**
1778. British **evacuation of Philadelphia** and retreat toward New York (**Monmouth**).
1778–79. **George Rogers Clark** marches through Illinois territory; capture of **Kaskaskia** and **Vincennes.**
1779. British defeat Americans and French near **Savannah; British occupy Georgia.**
1779. Naval battle between the **'Bonhomme Richard'** and the **'Serapis'** (**John Paul Jones**).

CRITICAL PERIOD—1783 TO 1789

1785. Maryland and Virginia delegates meet at Alexandria to consider commercial relations of the two states.
1786. Annapolis Convention to consider commerce of the country calls general convention at Philadelphia.
1786–87. **Shays' rebellion** in Massachusetts, caused by heavy taxes and general poverty, suppressed with difficulty.
1787. Northwest Ordinance organizes government in the Northwest Territory.

ARY PERIODS—TO 1789

1542. De Soto discovers the **Mississippi** River.
1540–42. **Coronado explores** the **Southwest.**
1565. Spanish found **St. Augustine.**
1584–90. **Raleigh attempts** to establish a **settlement** on Roanoke Island.

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OTHER EVENTS IN NORTH AMERICA

1604. Port Royal founded (**first** permanent **French settlement**).

1608. Quebec founded by **Champlain.**

1610. Hudson discovers Hudson Bay; **England claims the Hudson Bay region.**

1673. **Marquette** and **Joliet explore** the **Mississippi.**

1682. La Salle descends the Mississippi to its mouth.

1701. **Detroit** founded as French fort and trading post.

1718. French settle **New Orleans.**

CAROLINA

1663. **Charter** for Carolina **granted** to **Lord Clarendon** and others.

1669. Fundamental constitution drawn up by John Locke.

1680. **Charleston settled.**

1719–21. Overthrow of proprietary government.
1729–31. Division into North and South Carolina.

SOUTH CAROLINA

NORTH CAROLINA

PENNSYLVANIA

1681. **Charter** for **Pennsylvania** granted to **William Penn.**

1682. Philadelphia founded.

GEORGIA

1733. **Georgia settled by Oglethorpe.**

1752. **Georgia a royal colony.**

NORTH AMERICA—1689-1763

goyne's defeat); expedition against French at **Crown Point** (Battle of **Lake George, 1755**); capitulation of French frontier posts (Duquesne, Frontenac, etc.); **capture of Quebec** by **Wolfe** (1759). **France cedes Cape Breton, Canada,** etc., to **Great Britain** (Treaty of Paris, 1763).

1763-1774

1774. Boston Port Bill closing the port, and other acts to punish Massachusetts.

1774. First Continental Congress draws up **Declaration of Rights.**

1780. British victory at **Camden.**

1780–81. War in the South: **Charleston captured** by the British; battles of **King's Mountain, Cowpens, Guilford, Eutaw;** Cornwallis retreats to the north.

1781. Siege of **Yorktown; surrender of Cornwallis.**

1782. Evacuation of Savannah and Charleston; hostilities cease.

1783. Treaty of Paris: **Great Britain recognizes the independence of the colonies.**

1787. Federal Constitution framed by the **Constitutional Convention;** ratified by 11 states by end of 1788.

VI. UNITED STATES—1789 TO PRESENT

		OTHER COUNTRIES
1789	1789–97. **George Washington,** President, **John Adams,** Vice-President. **1789. First Congress** meets at New York; State, Treasury, and War departments organized. 1789. **First 10 Amendments** to the Constitution adopted by Congress and sent to states. 1790. First census: population, 3,929,214. 1790. **National debt funded;** state debts assumed by federal government. 1790–95. Indian war in the Northwest Territory. 1791. **First national bank** chartered by Congress. 1791. **Vermont admitted; Kentucky** (1792); **Tennessee** (1796). 1793. Eli Whitney invents the cotton gin. 1794. **Genet,** minister from France, **recalled** for unneutral acts. 1794. **Whisky rebellion** in western Pennsylvania against internal revenue law. **1794. Jay treaty** of amity and commerce with Great Britain.	1789. **French Revolution** begins. 1793. War between France and England. 1793–94. Reign of Terror in France.
1797	1797–1801. **John Adams,** President (Federalist); **Thomas Jefferson,** Vice-President (Democratic-Republican). 1797. **X Y Z Affair** with France leads to naval war; Alien and Sedition Acts passed against French partisans. **1798. Virginia and Kentucky resolutions** directed against **Alien** and **Sedition Acts** assert right of nullification. 1798. **Eleventh Amendment** adopted. **1800.** Presidential election: Republicans holding democratic ideas of strict construction and "states' rights" defeat aristocratic Federalists advocating strongly centralized government. 1801. **John Marshall** made Chief Justice.	1799. **Napoleon** made First Consul.
1801	1801–09. **Thomas Jefferson,** President (Democratic-Republican); **Aaron Burr** (1801–05), **George Clinton** (1805–09), Vice-Presidents. 1801–05. **War with Tripoli;** end of tribute to Barbary states. 1803. **Ohio admitted.** 1803. **Louisiana Purchase** from France extends U. S. boundary to Rockies. 1804. **Twelfth Amendment** provides separate ballots for president and vice-president. 1807. Fulton's steamboat makes successful trial voyage. 1807. Dispute with Great Britain over neutral commerce and the impressment of seamen (**Chesapeake Affair**). 1807–09. Embargo against Great Britain and France in retaliation for their blockade of European ports. 1808. Importation of slaves prohibited.	1804. **Napoleon** becomes **emperor.** 1806. Napoleon establishes **Continental** ("paper") **Blockade.** 1806. England issues **Orders in Council** blockading French territories.
1809	1809–17. **James Madison,** President (Democratic-Republican); **George Clinton** (1809–13), **Elbridge Gerry** (1813–17), Vice-Presidents. 1811–14. Indian war in the West (**Tippecanoe**). 1812. **Louisiana admitted; Indiana** (1816). **1812–15. War with Great Britain.** Unsuccessful invasions of Canada (1812, 1814); **British take Washington** (1814); **Battle of New Orleans** (1815). Numerous naval duels; Perry's **victory** on **Lake Erie** (1813). **Treaty of Ghent** (1814). 1814. **Hartford Convention** protests against embargo and war. 1816. Second national bank chartered. 1816. Mildly protective tariff passed.	1810–25. **Spanish** and **Portuguese colonies** in Central and South America become **independent.** 1815. Battle of **Waterloo.** 1815. **Treaty of Vienna; Holy Alliance formed.**
1817	1817–25. **James Monroe,** President (Democratic-Republican); **D. D. Tompkins,** Vice-President (1817–25). 1817. **Mississippi admitted; Illinois** (1818); **Alabama** (1819); **Maine** (1820); **Missouri** (1821). 1817. **Seminole Indian War** in Florida. 1818. Great Britain and the United States agree upon joint occupation of Oregon territory. **1819. Florida acquired** from Spain. **1820. Missouri Compromise** on question of slavery in territories. **1823. Monroe Doctrine** advanced against the aggression of the Holy Alliance in America. 1824. Protective tariff passed. 1824. Internal Improvements Bill passed.	1821. **Russia** attempts to restrict trade on North Pacific coast.
1825	1825–29. **John Quincy Adams,** President (Democratic-Republican); **John C. Calhoun,** Vice-President. 1825. **Erie Canal** completed. 1828. "Tariff of Abominations"; **tariff becomes a live issue.**	

		OTHER COUNTRIES
1829	1829–37. **Andrew Jackson,** President (Democrat); **John C. Calhoun** (1829–33), **Martin Van Buren** (1833–37), Vice-Presidents. 1829. **"Spoils system"** appointments to office. 1830. **Webster-Hayne debate** on **"state rights."** 1830. **Baltimore and Ohio Railway opened,** first steam locomotive in America. 1831. William Lloyd Garrison establishes **The Liberator,** a journal advocating abolition of negro slavery. 1832. New tariff bill reduces duties but retains principle of protection. 1832. South Carolina passes **ordinance "nullifying"** the tariff; Jackson's proclamation denounces nullification; **"Force Bill"** passed (1832); **Compromise tariff** (1833); nullification ordinance repealed. 1832. Jackson reëlected; system of **national nominating conventions** begins. 1832–37. Jackson's **war on the National Bank;** act for renewal of charter vetoed; government deposits removed (1833). 1835–42. War against **Seminole Indians** in Florida. 1836. **Arkansas** admitted; **Michigan** (1837). 1836. **"Specie circular"** issued requiring the payments for public lands to be made in specie.	1830. Independent monarchy established in Belgium. 1830. **Louis Philippe** ascends French throne. 1832. English parliamentary **Reform Bill** passed. 1835. **Texas** secedes from Mexico and **establishes an independent state.**
1837	1837–41. **Martin Van Buren,** President (Democrat); **R. M. Johnson,** Vice-President. 1837. **Financial panic,** due to over-speculation and unsound financial policies. 1840. **Independent treasury established.** 1840. **"Hard cider" campaign** results in a Whig victory.	1837. Queen **Victoria** of England begins her long reign.
1841	1841. **William Henry Harrison,** President (Whig); **John Tyler,** Vice-President. 1841. Death of Harrison.	
	1841–45. **John Tyler,** President (Whig). 1841. Tyler vetoes bill to reëstablish the national bank (1841) and bill for a "Fiscal Corporation"; break between Tyler and the Whigs; entire cabinet resigns. 1842. **Webster-Ashburton treaty** with Great Britain settles the Northeast boundary dispute. 1842. **Dorr Rebellion** in Rhode Island secures liberal constitution. 1844. **First telegraph,** between Washington and Baltimore, completed. 1844. James K. Polk (Democrat) elected President. 1845. **Texas annexed** to the United States; **Florida** admitted.	
1845	1845–49. **James K. Polk,** President (Democrat); **George M. Dallas,** Vice-President. 1846. **Iowa** admitted; **Wisconsin** (1848). 1846. **Northwest boundary** line settled at **49th parallel** by treaty with Great Britain. 1846. Low tariff enacted. 1846–48. **Mexican War.** American victories at **Buena Vista** (1847); **Cerro Gordo** (1847); capture of **Mexico City** (1847). **Treaty of Guadalupe Hidalgo** (1848), Mexico relinquishes claims to Texas; cedes **New Mexico and Upper California to United States.** 1846. Wilmot Proviso prohibiting slavery in territories acquired from Mexico defeated. 1848. Territory of **Oregon organized** without slavery. 1848. Presidential election results in Whig victory. Formation of the **Free Soil Party.**	1846. Great Britain **repeals corn laws; free trade** established. 1848. **Revolutions** in France and Italy; **second French Republic** founded.
1849	1849–50. **Zachary Taylor,** President (Whig); **Millard Fillmore,** Vice-President. 1849. Rush of gold seekers to California. 1850. **Clayton-Bulwer** treaty with Great Britain provides that neither country should have exclusive control over any canal built across Nicaragua or Panama isthmus. 1850. Death of President Taylor.	
	1850–53. **Millard Fillmore,** President (Whig). 1850. **"Clay's Compromise":** California admitted as a free state; other territory acquired from Mexico left open to slavery; slave trade abolished in the District of Columbia; new Fugitive Slave Law enacted. 1850. Maine adopts **prohibition.** 1851. Rail connection established between New York City and Lake Erie at Buffalo. 1852. **'Uncle Tom's Cabin'** published; stimulates growth of abolition sentiment in North. 1852. Franklin Pierce (Democrat) elected president.	1852. **Louis Napoleon** proclaimed emperor of France.
1853	1853–57. **Franklin Pierce,** President (Democrat); **William R. King,** Vice-President. 1853. **Gadsden Purchase** settles boundary dispute with Mexico. 1854. **Kansas-Nebraska Bill** repeals Missouri Compromise and organizes Kansas and Nebraska on the principle of **"squatter sovereignty."** Civil war in Kansas between free state and slave state settlers (1855–57). 1854. Treaty with Great Britain establishes reciprocity with Canada. 1854. Admiral **Perry** secures the **opening of Japanese ports** to foreign trade. 1854–55. **"Know Nothing" Party,** a secret party opposed to foreigners participating in American politics, at the height of its power. 1854–55. Movement to add slave territory to the United States; Ostend manifesto favors annexation of Cuba (1854); filibustering expedition to Nicaragua (1855). 1856. **First Republican national convention adopts anti-slavery platform.**	**1854–56. Crimean War.**
1857	1857–61. **James Buchanan,** President (Democrat); **J. C. Breckenridge,** Vice-President. 1857. **Dred Scott decision** maintains that neither negro slaves nor their descendants can become citizens; that a slave does not become free by being carried to free territories. 1858. **Minnesota** admitted; **Oregon** (1859); **Kansas** (1861). 1859. John Brown's raid on the United States arsenal at Harper's Ferry. 1860. **Abraham Lincoln** (Republican) **elected president.** 1861. **South Carolina secedes** from the Union; **other Southern states secede to form a confederacy.**	**1861. Italy united** under Victor Emmanuel.

		OTHER COUNTRIES
1861	1861–65. **Abraham Lincoln,** President (Republican); **Hannibal Hamlin** (1861–65), **Andrew Johnson** (1865), Vice-Presidents. **1861–65. Civil War.** **1861. Apr. 12. Fort Sumter fired upon** by the Confederates. 1861. July 21. Union army defeated at **Bull Run.** 1861. Seizure of Confederate commissioners (**Mason** and **Slidell**) from British steamship nearly leads to war. 1862. Apr. 6–7. Grant's victory at **Shiloh;** McClellan's **peninsular campaign** (Mar.-July); naval battle (Mar. 9) between **Monitor** and **Merrimac; New Orleans** captured by **Farragut** (Apr. 23). 1862. **Slavery abolished in the District of Columbia.** 1863. Jan. 1. Lincoln issues the **Emancipation Proclamation.** 1863. July 1–3. Union victory at **Gettysburg; Vicksburg** captured (July 4). 1863. **West Virginia** admitted as a free state. 1864. **Grant** made commander-in-chief of the Union armies. **Sheridan's raid** up the Shenandoah Valley; **Sherman's march** to the sea; capture of **Mobile.** 1864. **Nevada** admitted. 1864. Lincoln reëlected. **1865. Apr. 9. Lee surrenders at Appomattox Court House.** 1865. Apr. 14. **Lincoln assassinated.**	1861–88. **William I** king of Prussia. 1861–67. **Maximilian** attempts to found **monarchy in Mexico.**
1865	1865–69. **Andrew Johnson,** President (Republican). 1865. Proclamation extending **amnesty** to the South (14 classes excepted). 1865. **Thirteenth Amendment prohibits slavery** in the United States. 1865–67. President quarrels with Congress over the reconstruction policy; Congress passes over his veto **Civil Rights Bill** to extend citizenship to freedmen (1866), act continuing **Freedmen's Bureau, Reconstruction Act** (1867), and **Tenure of Office Bill** (1867). 1867. **Alaska** purchased from Russia; **Nebraska** admitted to the Union. 1867. Johnson forces French to withdraw army from Mexico. 1868. President impeached; conviction fails by one vote (two-thirds of Senate required). 1868. **Fourteenth Amendment extends citizenship to freedmen.**	**1866. Austro-Prussian War.** **1866.** Permanent **Atlantic cable laid.** 1867. **Dual monarchy** of Austria-Hungary established.
1869	1869–77. **Ulysses S. Grant,** President (Republican); **Schuyler Colfax** (1869–73), **Henry Wilson** (1873–77), Vice-Presidents. 1870. **Fifteenth Amendment extends franchise to the negroes.** 1871. **Treaty of Washington** with Great Britain provides for a clearer definition of the Oregon boundary, settlement of disputes over the Canadian fisheries, and arbitration of the "Alabama claims." **1872. General Amnesty Act** restores most of the ex-Confederates to their civil and political rights. 1872. Grant reëlected; **National Reform-Labor Party** adopts platform of labor and economic reform; **Prohibition Party** names presidential candidates. 1873. Financial panic. 1873. Grant vetoes bill to increase paper money; Congress decides to **resume specie payments** (1875). 1872–74. Political scandals: **"Credit Mobilier"** implicates public men in Union Pacific scandal; **"Salary Grab" Act** greatly increasing congressmen's salaries (1873); **Whiskey Ring conspiracy** to defraud government of internal revenue on distilled liquors (1874). 1876. **Colorado** admitted. 1876. Election returns disputed; commission declares Republican candidate elected (Rutherford B. Hayes). 1876. Custer Indian massacre in Montana.	1869. **Suez Canal opened.** 1870–71. **Franco-Prussian War.** **1870. Third French Republic** proclaimed. **1870. Union of Italy completed.** 1871. **German Empire** established.
1877	1877–81. **Rutherford B. Hayes,** President (Republican); **William A. Wheeler,** Vice-President. 1877. **Federal troops withdrawn from the South.** 1877. Railroad and miners' strikes contribute to widespread **industrial depression.** 1878. **Greenback Party** favoring "cheap money" at height of power. 1878. **Bland-Allison Act** for purchase and coinage of silver passed over Hayes' veto. **1879. Specie payments resumed.** 1880. Hayes fails of renomination because of his differences with party politicians.	1877–78. **Russo-Turkish War.**
1881	1881. **James A. Garfield,** President (Republican); **Chester A. Arthur,** Vice-President. 1881. Garfield assassinated (July 2).	
	1881–85. **Chester A. Arthur,** President (Republican). 1883. Pendleton **Civil Service Reform Bill** passed. 1884. Civil government established in Alaska. 1884. Bitter presidential election campaign; independent Republicans ("Mugwumps") swing to Democratic support.	1882. **Triple Alliance** formed between Germany, Austria, and Italy. 1884. **Partition of Africa.**
1885	1885–89. **Grover Cleveland,** President (Democrat); **T. A. Hendricks,** Vice-President. 1885. Immigration of contract laborers forbidden. 1887. **Interstate Commerce Act** passed; beginning of national regulation of railroads. 1888. Bill for tariff for revenue only fails to pass Congress. 1889. **Department of Agriculture** established.	1888–1918. **William II** emperor of Germany.
1889	1889–93. **Benjamin Harrison,** President (Republican); **Levi P. Morton,** Vice-President. 1889–90. Admission of **North and South Dakota, Idaho, Montana, Washington,** and **Wyoming.** 1889. **Oklahoma** thrown open to settlement. 1890. **McKinley tariff** establishes protectionist principle. 1890. **Sherman Anti-Trust Act** passed to prevent monopolies by corporations. 1890 **Silver Purchase Act** provides for monthly purchases of silver to be paid for in treasury notes. 1890. Controversy with Germany over the **Samoan Islands** settled by the Treaty of Berlin. 1891. **People's Party** (Populists) formed. 1892. Cleveland (Democrat) elected again on tariff issue. 1893. **Bering Sea controversy** with Great Britain referred to arbitration.	1891. **Dual Alliance** of **France** and Russia announced.

		OTHER COUNTRIES
1893	1893–97. **Grover Cleveland,** President (Democrat); **Adlai E. Stevenson,** Vice-President. 1893. Treaty for the annexation of Hawaii withdrawn from Senate. **1893. Financial panic.** 1893. Silver Purchase Act repealed and **gold standard supported.** 1894. Tariff duties reduced. 1894. **Pullman railroad strikes** suppressed by Federal troops. 1895. United States demand for arbitration of **British-Venezuelan controversy** acceded to by Great Britain. 1896. **Utah** admitted to the union.	
1897	1897–1901. **William McKinley,** President (Republican); **Garret Hobart** (1897–1901), **Theodore Roosevelt** (1901), Vice-Presidents. 1897. **Dingley tariff** reëstablishes high protection. 1898. United States battleship **Maine** blown up in Havana harbor. **1898. Spanish-American War:** Spanish fleets destroyed at **Manila Bay** and **Santiago;** invasion of Cuba. Spain recognizes **Cuban independence; Porto Rico, Guam,** and the **Philippines** ceded to United States; **Cuba occupied** by United States until 1902. 1898. **Hawaii annexed** to the United States; **Samoan Islands divided** with Germany. 1899. Insurrection in the Philippines suppressed; civil government established. 1899. Secretary **Hay** obtains recognition of the **"Open Door" policy** toward China. 1900. Currency law adopts **gold standard.** 1900. Reëlection of McKinley on the "full dinner-pail" platform. 1901. McKinley assassinated (Sept. 6).	1897. **Marconi** perfects the **wireless telegraph.** 1899–1902. **Boer War** in South Africa. **1899. First Hague Peace Conference.** 1900. **Boxer uprising** in China.
1901	1901–09. **Theodore Roosevelt,** President (Republican); **Charles W. Fairbanks,** Vice-President (1905–09). 1901. **Hay-Pauncefote** treaty with Great Britain allows United States to build Panama Canal on condition that it be open to all nations on equal terms. 1902. French interests in **Panama Canal purchased; canal zone obtained** from Panama by treaty (1904). 1902. **Anthracite coal strike** settled by commission appointed by the President. 1903. **Alaskan boundary dispute** with Great Britain settled. 1903. Beginning of **stricter government regulation of transportation and trade; Department of Commerce and Labor** created, railroad rebates abolished (1903); jurisdiction of Interstate Commerce Commission extended (1905); suits brought against trusts under Sherman Anti-Trust Law; **Hepburn Act** regulating railroad rates passed (1906); Meat Inspection and Pure Food Acts passed (1906). 1903. **Development of democratic government;** state-wide **primary election law** in Wisconsin followed by widespread adoption in other states; **initiative and referendum** adopted by Oregon (1902). 1905. **Intervention in Santo Domingo** to establish financial responsibility. 1906–09. **Intervention in Cuba** to restore order following armed revolt. 1907. **Oklahoma** admitted as a state. 1908. Movement for the **conservation of natural resources** begun.	1901–10. **Edward VII** king of England. 1902. **Trans-Siberian railway** opened. 1903. **Panama** declares itself an **independent republic; immediate recognition** by President Roosevelt. 1904–1905. **Russo-Japanese War;** mediation of Roosevelt results in the **Peace of Portsmouth.** **1907. Second Hague Peace Conference.** 1907. **Triple Entente** formed between Great Britain, France, and Russia. **1908–1909. Naval Conference at London** adopts rules for naval warfare.
1909	1909–13. **William Howard Taft,** President (Republican); **James S. Sherman,** Vice-President. 1909. **Dispute with Venezuela** arbitrated. 1909. **Payne-Aldrich tariff** passes (opposed by Progressive Republicans). 1910–13. Administration pursues **policy of non-intervention in Mexican revolutions.** 1910. Rules of the House of Representatives reformed. 1910. Coalition of insurgents with Democrats in congressional elections results in Democratic majority in the House. 1910. Postal savings bank created; parcel post, 1912. 1911. Canada refuses to ratify reciprocity treaty. 1911. Bills for tariff reductions vetoed by President. 1912. **Panama Canal Tolls Act** exempts American coastwise shipping from tolls. 1912. Territorial government established in Alaska. 1912. **Arizona** and **New Mexico** admitted as states. 1912. **Arbitration treaties** with Great Britain and France ratified. 1913. **Sixteenth Amendment** gives Congress power to levy **income tax.** 1912. Taft renominated; **Progressive Party** nominates Roosevelt; Woodrow Wilson, Democrat, elected.	1909. Commander **Peary** reaches **North Pole.** 1910. **George V** becomes king of England. **1911. Revolution in Mexico;** Diaz resigns. 1911–12. **War between Italy and Turkey** in Tripoli. 1911. **Amundsen** reaches **South Pole.** 1912–13. **Wars between Balkan allies and Turkey.** **1912. Chinese Republic** proclaimed.
1913	1913–21. **Woodrow Wilson,** President (Democrat); **Thomas R. Marshall,** Vice-President. 1913. **Seventeenth Amendment provides for election of senators by the people.** 1913. **Underwood-Simmons tariff** lowers duties. 1913. **Federal reserve system** of banks created. 1913–14. Many **peace and arbitration treaties** negotiated by **Bryan** as Secretary of State. 1914. Federal Trade Commission created; Clayton Anti-Trust Act passed; graduated **income tax law** passed. 1914. Panama Canal Tolls Act repealed; **canal opened.** 1914. Dispute with Mexico over "Tampico incident"; **American troops occupy Vera Cruz.** **1914. Neutrality in European war proclaimed.** 1916. Tariff Commission created. 1916. **Adamson Law** establishes eight-hour day for railway employees. 1916. Punitive **expedition** sent **into Mexico.** **1916. Wilson reëlected on a peace platform.** **1917. War declared against Germany** (*see* Outline III for World War). 1918. Republican Congress elected. 1919. **Eighteenth Amendment establishes nation-wide prohibition.** **1919. Treaty of Versailles fails** to receive two-thirds majority **in the Senate.** 1920. **Nineteenth Amendment establishes nation-wide woman suffrage.**	1914. Direct wireless communication established between Germany and United States. **1914–18. World War.** 1919. **Treaty of Versailles** signed. 1919. First transatlantic **flights,** both airplane and dirigible. **1920. League of Nations established.**
1921	1921. **Warren G. Harding,** President (Republican); **Calvin Coolidge,** Vice-President. 1921. **Budget Bill** passed establishing **budget system** in national finance. 1921. **Treaty with Colombia** ratified paying her $25,000,000 to settle Canal Zone dispute. 1921. Bill passed greatly **restricting immigration.** **1921.** President signs joint Congressional resolution declaring **peace with Germany and Austria** (July 2). 1921. **Limitation of Armament Conference** at Washington prepares **Four Power Treaty** between U. S., Great Britain, France, and Japan, for maintaining peace in the Pacific (signed Dec. 13) and **Five Power Naval Treaty** between U. S., Great Britain, France, Italy, and Japan limiting naval tonnage (signed Feb. 1, 1922. Four Power and Five Power treaties **ratified** by Senate (Mar. 29, 1922). 1922. Strikes of coal miners and railroad shop workers keep a million men idle from two and a half to five months. 1922. **Fordney-McCumber Tariff Act** passed, raising duties to high level. 1922. November elections reduce Republican majority in Senate to 10, in House to 15. 1923. President Harding dies (Aug. 2); Coolidge succeeds to presidency.	1921. Famines in Russia and China. 1921. Ex-Emperor Charles unsuccessfully attempts to regain throne of Hungary; exiled to Madeira. 1922. European economic conference, including German and Russian delegates, at **Genoa.** 1922. Tomb of King **Tutankhamen** of Egypt (about 1350 B. C.) discovered near Luxor. 1923. Diplomatic relations resumed between Mexico and the United States.

HITTITES (*hĭt'īts*). In Asia Minor, that ancient battleground between the East and the West, it was the fate of many a nation to rise to power and glory, and then fall into obscurity. But probably no other people of that region were for many centuries so utterly forgotten as the Hittites, who more than 3,000 years ago had not only made their power felt in all parts of Asia Minor but had spread over part of Syria and Mesopotamia. Except for some references in the Bible, this interesting people was entirely unknown to the modern world until recent years. Then scholars found their story in buried monuments and inscriptions, and traced their influence on their Asiatic neighbors and even on the Greeks across the Aegean Sea. It is now thought that we can trace some of their features in the Hebrews of today, while the Armenians at present living in the Hittite country have the same general profile. Only a beginning has been made in deciphering Hittite inscriptions, and much of their story remains untold.

TESTS OF SKILL IN FIELD HOCKEY

The picture above was taken just at the moment when a "White" player has scored a goal for his side by driving the ball between the goal posts. At the left two players are "bullying" the ball to start the game. A player from each side alternately strikes the ground and then his opponent's stick three times, after which either may strike the ball. The man at the right has just made a stroke with the reverse side of his stick. Ice hockey, which is better known in America, is similar to field hockey, except that there are seven players to a side instead of eleven, and the game is played on the ice, with the players on skates.

Among the most interesting remains of Hittite civilization are the sculptures carved in the living rock. Some of these depict vivid scenes of stag and lion hunts, and show that the Hittites were among the earliest peoples to make use of the horse; others represent processions of men paying homage to the gods. The architecture of the Hittites resembles that of the Assyrians in many respects. As between the Hittites and their neighbors, such as the Assyrians, it is hard to tell who were the originators and who were the imitators, but certain it is that many civilizations mingled in this ancient land. Among the carved figures in Hittite ruins is the double eagle, found also in the Babylonian coat of arms.

The Hittite religion was a sort of Nature worship. They worshiped many gods, but their chief deity was the Great Mother, the goddess who caused the earth to bring forth its fruit for man.

The Hittites first appear in history about 2000 B.C., when there were a number of tribes among them, each with its own king. About 1500 B.C. one of these tribes gained the leadership and controlled a great empire. For about two centuries and a half this empire maintained its power, and then invasion by new peoples and wars with Assyria and Egypt weakened it. Finally Sargon II of Assyria, in 717 B.C., put an end to the Hittite empire. After that the Hittites were absorbed by other peoples, and their civilization became a fading memory.

HOCKEY. Field hockey, as played today, is the development of a game known in the British Isles for centuries under the names "hurley," "shinty," and "bandy." A crude form of the game was also played very early on the European continent; and in the Copenhagen National Museum there is an altar pot, made about the year 1330, on which are shown two hockey players with sticks and a ball.

Modern hockey is very much like association football. The main difference is that in hockey the players hit a small solid ball with a stick, whereas in association football they kick a large inflated ball. Hockey is one of the best of games, and in America it is even more enthusiastically played by girls than it is by boys. Many girls' schools have hockey teams and there is great enthusiasm for inter-class and inter-school matches.

The regulation field is 100 yards long and 60 yards wide, but the game is often played on smaller fields. The goals at either end are 12 feet wide and 7 feet high. In front of each goal is drawn a flattened semi-circle with radii of 75 yards from the goal posts. The attacking side cannot score a goal unless the ball was last hit by one of their team inside this roughly semi-circular area.

A cricket ball, painted white, is used. The sticks are hooked clubs not more than two inches wide in any part and with a flat face along the crook. A team usually consists of 11 players—5 forwards, 3 halfbacks, 2 backs, and a goal-keeper. The game is divided into two halves not longer than 35 minutes each, and the teams change sides at the end of each half.

A recent development of field hockey is ice hockey, the national winter sport of Canada, also a popular game in the northern part of the United States. The American Amateur Hockey League was formed in 1896. There are 7 men on a team—4 forwards (the right and left centers and the right and left wings) and 3 defense men (the cover-point, the point, and the goal-tender). In place of a ball is substituted a "puck" or disk made of hard rubber, 1 inch thick and 3 inches in diameter. The stick is not more than 3 inches wide at any point and has a blade not more than 13 inches long. The well-equipped hockey player wears strips of felt about an inch thick to protect his shins and knees. His skates preferably are permanently attached to the skating shoes by rivets.

There are no standard dimensions for the rink, but usually the game is played on a space inclosed by side boards 200 feet long by 90 feet wide. The goals are 6 feet wide, 4 feet high, and are placed at least 10 feet from the ends of the rink. A goal is scored when the puck passes between the goal posts.

Ice hockey calls not only for great skill in the art of skating, but for close team-work, the team-mates passing the puck back and forth to each other or "caroming" it off the side boards, as they dodge down the ice and penetrate their opponents' defense.

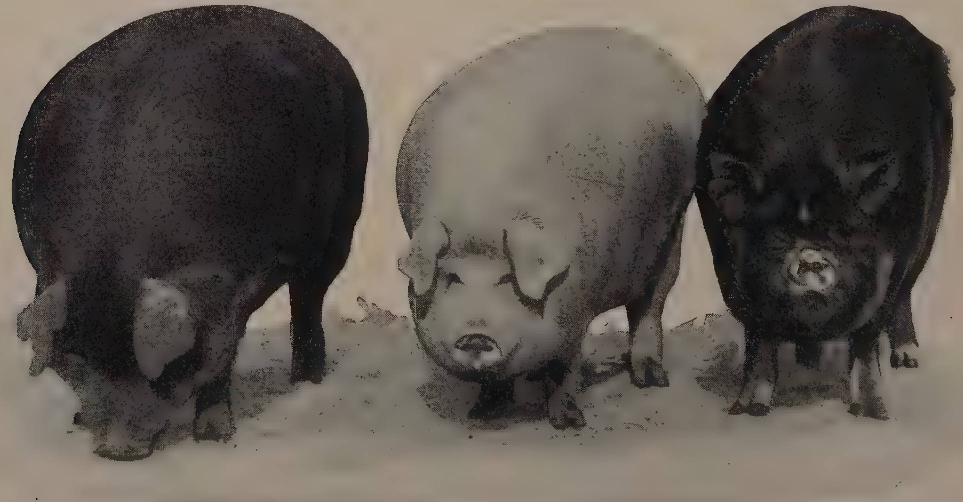
Hog. To be likened to a hog or pig is looked upon as an unpardonable insult, because it is understood to imply either greediness or filthiness, and all Jews and Mohammedans regard the hog as "unclean" and unfit for human food. But really the hog is no more greedy than any other animal, and in its natural state, instead of being dirty or filthy, it is exceptionally cleanly and will not live in filth if this can be avoided. It is remarkable that despite the religious prohibition against the use of "pork," as swine flesh is called, the hog furnishes a very great part of the meat diet of mankind.

It must be lots of fun to be a member of a Pig Club, as are the cute little fellows we see here, and it is just as much fun to be a farmer boy and belong to a boys' and girls' "Pig Club."

Varieties of wild hogs are found on every continent except Australia. Domestication began in China 7,000 years ago. The domestic hog of Europe and America is descended from the wild boar of Europe, which was in all probability crossed with the Neapolitan and Chinese varieties. (*See* Boar.)

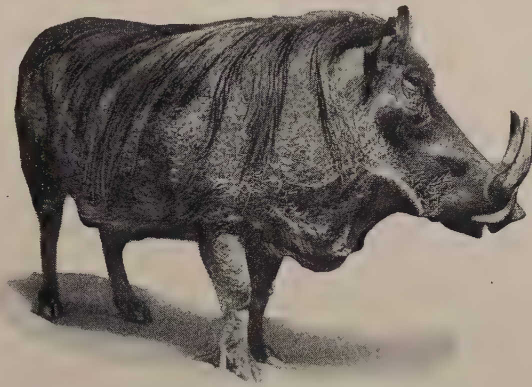
In China the hog is sometimes used as a draft animal, and it is not rare to see a woman, a hog, a horse, and an ass all harnessed together to drag a cart. A hog and a cow are frequently hitched up together. In England a hog-breeder once drove to a fair with four hogs drawing his carriage. Hogs are easily trained to perform various tricks, for they are intelligent and quick to learn some things. On the

THREE MEMBERS OF THE HOG ARISTOCRACY


These represent some of the most famous breeds of Swine. From left to right, they are Duroc, Chester White, and Berkshire. All are fine lard hogs, but the Berkshire is particularly noted for the excellent quality of bacon it provides.

other hand, they are so stubborn that it is said the best way to drive a hog in one direction is to pretend to drive it in the opposite one. In parts of Europe pigs are trained to find truffles, which are a sort of underground fungus highly esteemed for food.

GOODNESS, WHAT A FACE!



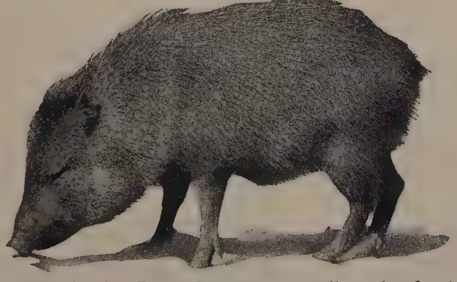
The Wart Hog is perhaps the most ridiculous-looking animal in the world. That long face with those strange tusks is bad enough, but when you think that his features are further distorted by those curious wartlike bumps near his eyes and along his nose, it seems as though Nature had indeed played a joke upon this African member of the pig family.

Hogs are very prolific and under favorable conditions produce two litters a year. There are from 6 to 15 or more young pigs in a litter. There is a record of one sow (the female hog) that bore 355 pigs in 20 litters. The mother hog does not take good care of her young, however, and frequently kills some, or an entire litter, by lying on them.

Young pigs born in the spring are marketed in the fall, attaining the normal weight by that time, if properly fed and cared for. An average hog is 80 inches long from nose to tail, and 38 inches high. It weighs from 300 to 400 pounds, depending on its condition; and unusually large ones weigh from 600 to 800 pounds, or even more. Every part of the hog is utilized—the meat for food; the fat (called lard) in cooking; the bristles in making brushes; and the skin, though usually not removed, makes good leather for saddles, purses and other purposes.

Of all animals the hog is the most economical producer of meat, and for that reason it is raised by nearly every farmer in the United States. Four or five pounds of dry feed given to a hog produce a pound of meat, while beef requires from 10 to 12 pounds of the same feed. A fat hog yields almost 80 per cent of its live weight as dressed meat, and a steer only 60 per cent. A hog eats garbage and other waste that no other animal will eat. A cow nine months after breeding produces one calf which weighs when marketed 300 pounds. A sow in the same period produces enough pigs to make 1,500 pounds of finished pork, and if bred a second time will produce a half dozen excellent pigs for a Thanksgiving roast besides.

DOUGHTY LITTLE WARRIORS



Although the Peccaries are so small—only about three feet long—even jaguars learn to think twice before attacking them, for they go in herds and the team work with their sharp tusks is very effective.

Hogs are subject to several diseases which sometimes cause great loss. Hog cholera is dreaded by every hog-raiser in America; in 1910 this scourge carried off 10 per cent of the hogs in the United States, causing a loss of $75,000,000. In recent years much relief has been secured by immunizing hogs with serum. Also a parasitic worm called "trichina" finds lodgment in the muscles of the hogs, and causes a serious disease which may be communicated to man.

Like human beings, hogs thrive in clean healthful surroundings, with a good supply of pure fresh water and a variety of wholesome food. While fattening they must be confined to narrow quarters or they will keep thin and wiry by too much exercise. The pen should be kept clean and dry.

The most popular varieties in America are the Poland China, which originated in Ohio, and the Chester Whites, an American strain of the English Yorkshire. The Duroc-Jersey is another popular breed. Several excellent varieties of hogs originated in Great Britain, among them the Berkshire, the Hampshire, the Tamworth, and the Ulster. Hog-breeders seek to develop a hog that is prolific, grows fast, fattens quickly and makes wholesome pork.

Hog-raising and pork-packing have become two of the great industries of the United States, which produces over 40 per cent of the world's supply of pork. "Pig clubs" of farmers' boys and girls to encourage better selection and rearing of hogs have been a brilliant success. The World War and the resulting shortage of fats added greatly to the profits of these industries, and under this stimulus the number of hogs in the United States increased in four years from about 59 million to over 71 million. Bacon was in special demand for export because of the high proportion of fat it contains, because it is easily cooked, and because it keeps well in any climate. The principal pork-packing establishments are located at Chicago, Kansas City, and Omaha. From these pork is shipped to all parts of the world. (*See also* Meat Packing.)

All hogs belong to the family *Suidae*, which also includes the American peccaries. The domesticated hog is known by the same name as his wild ancestor, the wild boar of Europe, *Sus scrofa*. Among other interesting varieties of wild swine are the long-tusked *Babirussa* of the island of Celebes, *Babirussa alfurus;* the African wart-hog, *Phacochoerus africanus;* and the river-hogs, of the genus *Potamochoerus*, several species of which are found in Africa and the adjacent islands. The hippopotamus is a near relative. The so-called Guinea pig is not a pig at all, but is a cavy, related to the hares and rabbits.

HOH'ENSTAUFEN. A German noble family of the Middle Ages to which belonged the Emperors from Conrad III (1138–1152) to Conrad IV (1250–1254) inclusive—with the exception of Otto IV (1198–1214), who was a member of the rival house of Welf (*see* Guelfs and Ghibellines). Castle Hohenstaufen, from which the family took its name, was in Swabia. The Hohenstaufen epoch was the most glorious period of medieval Germany, especially the reign of Frederick Barbarossa (1152–1190).

HOH'ENZOLLERN. The castle Zollern (or Hohenzollern), near the Danube River in Swabia (southwestern Germany), was first built by one Count Frederick in the year 980 (rebuilt 1850–67). From him is descended the family which, after 1415, gradually raised Brandenburg-Prussia to the rank of a first-rate power in Europe, and in 1871 founded the German Empire. Frederick II and William II are the most notable members of the family. The castle also gives its name to the tiny province of Hohenzollern (441 square miles; an outlying part of Prussia) which surrounds it. (*See* Prussia.)

HOLBEIN (*hōl'bīn*), **HANS** (1497–1543). In the long ago days when Luther was drifting into his revolt against the Roman Catholic Church, Hans Holbein, a young German artist, left his father's studio in the wealthy old cultured city of Augsburg, to seek his fortune in Basel, Switzerland. His purpose was to furnish illustrations for the wonderful new printed books that were there being published.

The busy Rhine city of Basel boasted in those days "at least one learned man in every house." Among these scholars was the famous Erasmus, who had come to Basel to oversee the publication of the first printed edition of the New Testament in the original Greek, and other works which he had edited. This wise man and the young artist at once struck up a friendship and Holbein drew pictures for a very clever satire, called 'The Praise of Folly' (*Encomium Moriae*), which Erasmus had written for relaxation and which his friends persuaded him to publish. The pictures were quite as clever as the text, and through all the 400 years since that time, whenever 'The Praise of Folly' has been reprinted, Hans Holbein's illustrations have been reprinted with it.

Holbein drew illustrations for many other books also, among them Martin Luther's translation of the Bible into German. He displayed great skill also in other lines. He painted pictures and portraits; he designed stained glass windows; he even drew designs for female costumes! The old saying that artists are born and not made must have been true in the case of Holbein, for without a magic gift from some good fairy, he could hardly, at the early age of 20 years, have excelled in so many lines.

SIR THOMAS MORE INTRODUCING HOLBEIN TO HIS FAMILY

Once, when they had hard times in Europe and people weren't buying many pictures, Holbein resolved to try his fortune in England. So he took letters of introduction from his friend Erasmus to Sir Thomas More, one of the important men at the English Court, and through him secured endless commissions to paint the portraits of the notables of England. The artist and the statesman became very intimate friends. More is here presenting Holbein to his family.

After a time religious strife between Catholics and Protestants became so bitter that life in Basel was most unsettled. Then Holbein, with a letter from his friend Erasmus to an Englishman of influence, again set out to try his fortune in a strange land. This time he went to London and there, thanks to Erasmus' letter, met with a favorable reception and later became court painter to Henry VIII. The king's fondness for Holbein has passed into a legend. When a nobleman complained of the favor shown the base-born artist, the king said: "My lord, know that of seven peasants I can easily make seven earls, but of the seven earls I cannot make one Holbein!"

In England Holbein was known chiefly as a painter of portraits. An old account of his services at the court of Henry VIII relates that he painted the portrait of the king, "life size, so well that everyone who looks is astonished, since it seems to live as if it moved its head and limbs." The account continues: "He made portraits of the principal folk of the realm in such numbers that it is a matter for wonder how he could ever have finished so many!"

Although his life was spent in Switzerland and England, Holbein is regarded as a German artist. Comparing him with the other master artists of that nation, it is said: "Dürer was the greater genius, a greater thinker, a greater engraver, but Holbein was the greatest painter Germany has ever produced."

His paintings and drawings are found in most of the larger galleries of Europe. His Madonna, in the grand Ducal Palace of Darmstadt, is one of Germany's masterpieces. His most celebrated picture is the portrait of his friend Erasmus, in the Louvre, Paris. The finest collection of the Holbein miniatures is that in the Metropolitan Museum of New York City.

HOLIDAYS AND FESTIVALS. Holidays have been observed in all ages and among practically all people. The Greeks had their Olympic games and many other festivals. The Romans celebrated Lupercalia in the spring and Saturnalia in mid-winter, marked by games, fantastic amusements, and the giving of presents. The earliest of all festivals seem to be connected with the dead, to whom offerings were made. Later they became attached to the sun and moon or to the seasons, seed-time and harvest being occasions for special festivity. All early festivals were in some measure religious, since feasting had always to be shared with the gods. Thus the word holiday meant originally "holy day." Political holidays, celebrating an important victory or the birth of some great leader, were of later growth. In some foreign countries the gradual increase of holidays, religious, national, and local, has led to official regulation.

In the United States there are no legal *national* holidays. Congress does, however, name special holidays and the various states can make them legal. In nearly all states New Year's Day (January 1), Washington's Birthday (February 22), Independence Day (July 4), Memorial Day (May 30 in the North and April 26 and June 10 in the Southern states), Labor Day (first Monday in September), Thanksgiving Day (last Thursday in November), and Christmas (December 25) are legal holidays by state action. Others generally celebrated are: Lincoln's Birthday (February 12), Arbor Day (fixed by governor), Flag Day (June 14), and Columbus Day (October 12). Another class of holidays which have no legal recognition but are firmly rooted in customs centuries old consist of Valentine's Day (February 14), April Fools' Day (April 1), May Day (May 1), Hallowe'en (October 31), and Mothers' Day (second Sunday in May). Mothers' Day is an old custom which has recently been revived by the suggestion of Congress.

In Canada these legal holidays are observed: Dominion Day (July 1), New Year's Day, Good Friday, Easter Monday, Christmas Day, Empire Day (May 24), Labor Day, and the birthday of the reigning British sovereign.

HOLLAND. That part of the modern Kingdom of the Netherlands which stretches east of the Zuider Zee and north of the River Rhine, and includes the richest and largest cities of the kingdom, such as The Hague (the capital), Amsterdam, Rotterdam, Haarlem, etc. The land is below sea level, and is protected by dikes. Because of the historical, economic, and political importance of the two provinces, North Holland and South Holland, the name "Holland" is frequently applied to the whole kingdom of the Netherlands. (*See* Netherlands, Kingdom of.)

HOLLY. When the Christmas season approaches, each home puts on its gala attire, and sprigs of holly adorn the chandelier and hang in wreaths in the windows. The bright red berries, conspicuous among the dark green prickly leaves, add a cheery note to the occasion. There are about 175 species of holly shrubs and trees, distributed throughout the world, all evergreens. In some of the species the leaves are blackish and they bear yellow or black berries.

In North America the holly is abundant on the bottom lands of eastern Texas and Arkansas, but it also occurs on the Atlantic coast from Massachusetts to Florida and in the Mississippi valley. The American holly sometimes forms a tree 50 feet in height. It is from this species that much of the commercial holly is taken. The European holly, which is even more beautiful than the American, is cultivated as a garden shrub, in America as well as in England. The close-grained white wood is admirably adapted to cabinet work.

Scientific name of American holly, *Ilex opaca*. Bark, light gray and smooth. Leaves simple, alternate, elliptical or oval, with pointed apex and base, having sharp, spinelike teeth. Fruit a small bright red berry which remains on the tree far into the winter.

HOLLYHOCK. Clothed with dark green leaves and thickly studded with large bright-hued blossoms, the tall stalks of this treasured old-fashioned plant make a beautiful and stately border for our gardens. Reaching a height of six or eight feet, its spikes stand in soldierly array, seeming to guard the more modest blossoms that cling closely to Mother Earth.

The hollyhock has been developed from the wild mallow, a native of Syria. It is believed to be the "holy mallow" discovered by the Crusaders and brought to Europe by way of Palestine. Originally it had single rose colored blossoms, but through centuries of cultivation numerous varieties of both double and single flowers have been produced, in many shades of pink and purple, as well as in yellow and white. The glory of the hollyhock has declined of late years because of a very destructive fungus which attacks the plant, making difficult of production the blossoms that once adorned the stalks to within two feet of the ground. The presence of this fungus is first indicated by small spots appearing on the stems and leaves of the plant. Soon afterward the leaves begin to look dry and scorched.

Scientific name, *Althaea rosea.* Flowers about 3 inches across, growing on short peduncles from the stalk; calyx 5-pointed, reinforced by a circle of 6 to 9 bracts; petals 5 in number, large, wedge-shaped, convolute in bud; stamens numerous, united in a tube; styles numerous. Stem tall, thick, hairy. Leaves 5 to 7-lobed, rough, rounded, heart-shaped.

OLIVER WENDELL HOLMES

"The Autocrat of the Breakfast Table"

HOLMES, OLIVER WENDELL (1809–1894). When James Russell Lowell chose Holmes to be the first prose writer for the new *Atlantic Monthly* (1857) he declared confidently: "The success of this magazine rests with Dr. Holmes. He has written little, but you'll see. His mind is like a bright mountain stream that has been dammed up in the hills, waiting only an outlet to the ocean. He has a wonderful store of thought—serious, comic, pathetic, and poetic." The delightful essays entitled 'The Autocrat of the Breakfast Table' proved Lowell a true prophet, for nothing so witty and wise, so humorous and kindly, had been produced in America. In whatever he wrote, Holmes showed a boy's freshness, a man's energy and purpose, a poet's gift, and the high moral tone that marked the work of the great New England writers of his day. And in putting his thoughts on paper he lost none of the sparkle and personal charm that made him a celebrity as conversationalist and lecturer.

Dr. Holmes' success as a writer was the more remarkable because writing was not his chief business. He was a busy physician and Harvard professor, who, besides caring for his big practice, made original scientific investigations and wrote medical works. He was born in Cambridge, Mass. His father was a Congregational minister, professor at Harvard, and historian. Holmes himself had the advantages which he said belonged to a man of family—namely, "four or five generations of gentlemen and gentlewomen" back of him, and "the tumbling about in a library as a child." His life was a busy and uniformly successful one, free from startling events or great misfortunes. After his college days at Harvard he had studied law; then he had taken up medicine, studying in Boston and in Europe.

His fame as a writer began while he was still in college, with his poem 'Old Ironsides', that saved the old frigate *Constitution* from destruction. The volume that contained the funny 'My Aunt' and the inimitable humorous-pathetic 'Last Leaf' appeared the year that he took his M.D. degree at Harvard. So often was Holmes called upon for verses for special occasions that he has been called the poet laureate of Boston. The reputation that his 'Autocrat of the Breakfast Table' brought him never dimmed. He followed those essays with 'The Professor at the Breakfast Table' and 'The Poet at the Breakfast Table', and found time also to write two novels. Not all Holmes' poetry was humorous, as was 'The Wonderful One-Hoss Shay'. Some of it was beautiful and inspiring, like 'The Chambered Nautilus', whose last stanza reads:

Build thee more stately mansions, O my soul,
As the swift seasons roll!
Leave thy low-vaulted past!
Let each new temple, nobler than the last,
Shut thee from heaven with a dome more vast,
Till thou at length art free,
Leaving thine outgrown shell by life's unresting sea!

Holmes was one of those who can be wise and witty and at the same time cheerful and kind. He could share his knowledge and his culture with people without the slightest hint of chilling superiority. He was well loved all his life long, and received many honors both in his own country and in Europe.

Holmes' principal works were: *Volumes of poems*—'Songs in Many Keys' (1861); 'Songs of Many Seasons' (1874); 'The Iron Gate' (1880). *Novels*—'Elsie Venner' (1861); 'The Guardian Angel' (1867). *Essays*—'The Autocrat of the Breakfast Table' (1857–58); 'The Professor at the Breakfast Table' (1859); 'The Poet at the Breakfast Table' (1872); 'Over the Teacups' (1891). *Memoirs*—'Memoir of John Lothrop Motley' (1879); 'Life of Ralph Waldo Emerson' (1884).

HOLY ROMAN EMPIRE. It was on Christmas Day of the year 800, when Pope Leo III in the church of St. Peter's in Rome placed a crown on the head of the Frankish king Charlemagne as he knelt in prayer, that the peculiar organization which we call the Holy Roman Empire first came into existence (*see* Charlemagne). Amid the breakup of the Frankish kingdom after Charlemagne's death, the Empire for a time disappeared. It was revived by the Saxon Otto I, king of Germany, in 962. From that time until its final abolition in 1806, the Empire maintained some sort of existence; but in its last three centuries it had become, in the language of the witty Frenchman Voltaire, "neither holy, nor Roman, nor an empire."

In theory the Holy Roman Empire was the counterpart in civil government of the universal Catholic church in religion. Just as God had placed the Pope over his church, so, it was reasoned, he had placed the emperor over all kings and princes. In practice the Empire after 962 included only Italy and Germany, and a wavering connection with Lorraine, Burgundy, Switzerland, and the Netherlands.

In theory the empire was elective. The Golden Bull of 1356, issued by the Emperor Charles IV, placed the hereditary right to elect in an Electoral College composed of the Archbishops of Mainz, Cologne, and Treves (Trier), the King of Bohemia, the Count Palatine of the Rhine (Pfalzgraf), the Duke of Saxony, and the Margrave of Brandenburg (Bavaria and Hanover were added later). In practice the election was practically hereditary in some one princely house for considerable periods. After the Carolingian and Saxon lines, the imperial crown was worn by the members of the following houses: The Franconian or Salian house (1024–1125), the Hohenstaufen (1125–1254), [Great Interregnum, 1254–1273], various houses (1273–1347), the Luxemburg-Bohemian Line (1347–1437), the Hapsburgs (1438–1806, except for one reign, 1740–1745). For further details *see* the article Germany and the biographical articles.

HOME ECONOMICS. Imagine the tasks that confronted the housewife of a century or two ago! She must not only make the clothing for the entire family, but she must also spin the yarn and make the cloth itself. Besides preparing every article of food, she must churn the butter by hand and must even make the soap and candles for the household. In fact she must do a thousand and one things that are done in factories and by machinery for the woman of today. It is little wonder that in those days training in household duties constituted a large part of a girl's education, and that her mother early began instructing her in the many tasks, large and small, which would fall to her lot when she undertook to manage a home of her own.

With the invention of various machines to lighten the housewife's burden, and the growing interest of women in politics, clubs, and various phases of social life which take them from household duties, less attention was paid to the accomplishments of the old-fashioned housewife, and girls were no longer trained in domestic affairs at home. And so the study of home economics, or domestic science, was devised by wise men and women and now constitutes an important department in most large high schools and in many colleges and technical schools.

Some of the main branches taught under this heading are cooking and dietetics, house sanitation, laundry work, sewing, dressmaking, millinery, history of costume, drawing, household design, household accounting, general household economics, and the care of young children. Emphasis is placed upon a mastery of the underlying principles rather than upon the acquirement of mere skill in the practice of any of these arts. While it is not necessary for the modern girl to learn to weave cloth, she must know enough about fabrics to buy wisely; and though she perhaps will not prepare every article of food, she must know what food elements the body needs, how foods should be prepared, and what the different kinds cost. The question of food, indeed, is one of the most important problems taken up by a student of household economics, and is a subject that is becoming vital and generally interesting. (*See* Cooking; Food.)

Then there is the question of sanitation and ventilation, which is equally important if the health of the family is to be preserved. A housewife must know the proper methods of cleaning, of keeping the plumbing in a sanitary condition; she must learn the importance of ridding the house not alone of roaches, but of flies and mosquitoes as well, and of keeping the house at the proper temperature and well ventilated. (*See* Heating and Ventilation; Hygiene.)

Though it is possible at the present day to buy every article of clothing ready-made, it is not always economical or satisfactory, and surely it is just as important for the modern girl to know how to sew and mend as it was for her grandmother. So a home economics course gives special attention to this branch of the art of home-making. (*See* Sewing.)

While the four main topics with which the study of home economics concerns itself are food, clothing, shelter, and home management, it draws information from many other fields for the solution of its problems —among them, history, economics, hygiene, chemistry, physics, physiology, and biology. A normal school course, to prepare teachers of the subject, lasts three years, and includes such educational subjects as psychology and the history of education, in addition to the technical work. (*See also* Nursing.)

HOMER. There is no greater name in poetry than that which stands for the unknown author or authors of the famous epics of Greece, the 'Iliad' and the 'Odyssey'. According to the ancient historian Herodotus, Homer was an Asiatic Greek who lived about 850 B.C. But the Greek historians themselves differ as to when he lived and where he was born, thus giving rise to the saying:

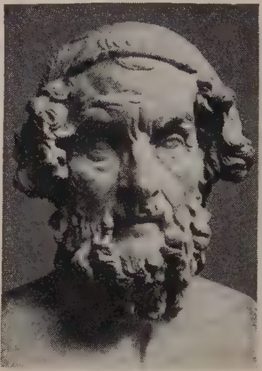
> Seven cities contend for Homer dead
> Through which the living Homer begged his bread.

Tradition pictures him as a blind old man, who wandered from place to place reciting his poems.

Many scholars, however, hold that the poems were not composed by a single person, and were not written until centuries after they took the form in which we know them. It is almost certain that they were long handed down from memory, as there is little evidence that writing was practiced in Greece at so early a period. One theory of their authorship is that they are the work or compilation of a company of poets or minstrels, who composed, collected, and handed down in this form the legends of the Trojan War. The 'Iliad' and the 'Odyssey' are sometimes referred to different writers, and sometimes to early and later periods of Homer's genius.

But the question of the authorship of the 'Iliad' and the 'Odyssey' is of little importance beside the poems themselves, which are the greatest epics of any age or country. Later poets, both ancient and modern, and in all lands have paid homage to the master, whom Tennyson called "the Ionian father of the rest."

The Greek war about Troy forms the basis of the poems. The 'Iliad' tells the story of "the wrath of Achilles," while the 'Odyssey' relates the many adventures of Odysseus (Ulysses) on his voyage home. Even though the poems contain only a shadow of historical fact, scholars owe a great debt to them for the information they furnish concerning early life in the lands about the Aegean Sea. Excavations by Schliemann and others on the site of Troy and elsewhere have abundantly confirmed the information from the poems (*see* Aegean Civilization; Schliemann, Heinrich).



HOMER
The Father of Poetry

One does not need to be a scholar to appreciate the wonderful stories in Homer, for they appeal to all, young and old alike. The boy or girl who reads the poems in translation or paraphrase cannot miss the charm of the story, or fail to be interested in the heroic characters, as he follows them through the stirring battle scenes of the 'Iliad' and through the many and strange adventures of the 'Odyssey'. Only the student of the Greek language, however, can fully appreciate the simple and lofty beauty of the style of the original, the directness and vigor of the "winged words," and the flowing music of the long, hexameter lines.

The best prose translations of Homer are those of the 'Iliad' by Lang, Leaf, and Myers; and the 'Odyssey' by Butcher and Lang. One of the best known translations in verse is that of Pope, but his version conveys less of the spirit of Homer than do those of other translators. The American poet William Cullen Bryant made a poetical translation of great merit. Some of the Homeric stories are retold in these volumes. (*See* Achilles; Circe; Cyclops; Hector; Odysseus; Trojan War).

HONDU'RAS. The history of Honduras goes back to the days of Christopher Columbus, whose first landing on the continent was at Cape Honduras in 1502; but this Central American republic is still one of the least developed regions in the New World. In spite of its great mineral wealth, fertile soil, great forests, and other natural resources, few vessels visit its low, swampy, fever-stricken Caribbean shore except the banana boats that ply to New Orleans and Mobile, or tramp steamers seeking cargoes of logwood, mahogany, or hides. The chief center of settlement is on the Pacific Ocean side.

A coasting steamer brings you from San Francisco or Los Angeles to the Gulf of Fonseca, one of the finest natural harbors in the world, and comes to anchor off Amapala, on Tigre Island, the Pacific gateway to the republic. From Amapala a gasoline launch will carry you to the mainland, where starts the 85-mile highway to Tegucigalpa, for this healthfully located capital (population, about 30,000) is the only capital in the New World which still lacks railroad connection with the coast. You will find this a city of low white houses with tile roofs, lying in the bend of a small river, surrounded by beautiful wooded hills.

A rough journey of many miles over mountainous roads northward from the capital brings you to the terminus of the one important government railway in Honduras, running inland from the harbor of Puerto Cortez on the Caribbean Sea, which some day will connect the Atlantic and Pacific coasts. In the interior the climate is healthful and the high plateaus are dotted with small cattle and hog ranches. In the warmer valleys coffee and tobacco, both of high quality, are grown. The chief crop is bananas; mostly on the Atlantic coast. Other crops are corn, the staple food of the people, beans, rice, wheat, sugar cane, coconuts, henequen (sisal hemp), and indigo. Hides, rubber, and ivory-nuts are among the exports. Gold, silver, copper, iron, coal, and other minerals are abundant but development has been slight.

The population is chiefly of Spanish and Indian descent, with a mixture of negro and Carib blood on the north coast. In some of the less explored regions dwell Indian tribes, little more civilized than were their ancestors when Columbus landed. The area of the republic (about 44,275 square miles) is slightly smaller than that of Pennsylvania. Most of the surface is mountainous, with heights ranging from 5,000 to 10,000 feet.

The first European settlement in Honduras was established by Hernando Cortez in 1524. For three centuries it shared the fate of the other Spanish provinces in America. Since independence was gained revolutions and civil war have been frequent. In 1907 United States marines were compelled to intervene at the close of a disastrous conflict with Nicaragua. In recent years the government has shown a tendency to encourage agricultural and commercial development and to provide better protection for foreign investments. As a result new railway construction has been undertaken at several points. Population, about 640,000. (*See* Central America.)

British Honduras (formerly called Belize) is a British crown colony founded early in the 17th century at the lower end of the Yucatan peninsula by poachers on the Spanish logwood forests. Conflicts with Spain lasted until 1798, and it was only after the revolt of Central America from Spanish rule that Great Britain's rights were clearly recognized. Area, about 8,600 square miles; population, about 45,000; capital, Belize (10,000 population).

LITTLE TALKS ON GREAT THINGS

by Arthur Mee

HONESTY

WE owe it to ourselves, to our neighbors, and to the world, to be honest. We must live with one another; the lives of others cross our own a hundred times a day, and there is no enduring happiness unless we treat one another fairly.

It is true, as the copybooks tell us at school, that honesty is the best policy. It will bring us hardships at times, but it will give us peace in the end. There are rogues and thieves who make fortunes; there are dishonest men who make a great noise and build up great wealth and seem to enjoy great happiness; but they live in no security, they are held in no esteem, and at any time the day after tomorrow may bring them clattering down.

It goes without saying that we must tell the truth—nothing but misery can come from falsehood. If men cannot believe us, they will have no dealings with us, or else they will deal with us as men who cannot be relied on. We depend on one another in all our daily lives. We depend on the truth of the timetable when we catch a train; we depend on the truth of a letter or a telegram; we depend on the word of our doctor or our druggist or our lawyer; we depend on a book that we consult for facts; we rely on a friend who tells us something he has seen. If we are not to believe all these, our lives are not worth living, for our time would be wasted, our facts would all be wrong; a false statement by a lawyer might bring us utter ruin, and a falsehood in a druggist's shop might bring us death.

We live and prosper by seeking and speaking the truth, and there is no other way to happiness. He who does not speak the truth will believe nobody else, and his life is one long round of uncertainty, haunted by the fear of being found out. Even though we suffer for it we must speak the truth. One lie leads on to another. A lie is like a snowball—it grows as it goes on its way. It leads a man from the shallows into the pit, from the marshes into the deep morass, and he is overwhelmed with shame and misery to find the sort of place to which a single lie often will bring him.

And of course we must pay our debts. We must not belong to that mean corner of the world which lives very well without much work, and flatters little tradesmen with its patronage, but forgets to pay its bills. Nor must we keep a tradesman waiting; he has his bills to pay as we have ours; and though the little bills we owe him may be small, the bills that he owes may be very big, and many an honest man has been ruined in this world by customers who would not pay their bills.

The honest man will seek no private ends in any public cause; he will be as honest to his country as to his neighbors and his friends. He will not put his trade, or his profit, or his personal advantage, before his country's interest. All through the politics and public life of every land runs the trail of dishonesty like that. There are men who care nothing for their country, but seek to win positions of power that they may serve some purpose of their own, and the good of the people and the welfare of the State are as nothing to them. Of all forms of dishonesty none is worse than this, for it corrupts a public cause, and thousands of people, or a whole nation, may suffer for one man's gain.

Nor will the honest man seek to protect himself unfairly from responsibility for what he says. It is right that a man should be responsible for his words, for words may be like poisoned arrows, and bring death or ruin in their train. What we have to say of a man let us say before his face as readily as behind his back. It is a wise rule and a safe one.

We should remember, when we speak, the spirit of those lines by Longfellow which show us how an arrow, or a song, or a word, may have an end we do not dream of:

> I shot an arrow into the air,
> It fell to earth, I knew not where . . .
>
> I breathed a song into the air,
> It fell to earth, I knew not where . . .
>
> Long, long afterward, in an oak
> I found the arrow, still unbroke;
>
> And the song, from beginning to end,
> I found again in the heart of a friend.

Let us be honest to all, to ourselves and to our country. Let us think ill of none without cause. Let us scorn to say the thing that is not true, scorn to take a mean advantage of another, scorn to repeat or even listen to the gossip of dullards and fools. So we bear ourselves worthily and need not to be ashamed, for "an honest man is the noblest work of God."

HONEYSUCKLE. Clinging tightly to neighboring plants in tangled rocky woodland or winding its way up the sides of fence or garden wall, the twining honeysuckle abloom with yellowish white or crimson trumpet-shaped flowers is indeed a pretty sight. Its smooth oval dark green leaves make a fitting background in summer for the dainty sweet-scented blossoms, and quite as charming is their contrast with the bright red berries that appear in the autumn. There are over a hundred species, growing wild or under cultivation, scattered through the Northern Hemisphere. About 25 are native to the United States and Canada.

The Honeysuckle is one of the most beautiful vines and is a favorite for decorating summer houses.

The familiar pale yellow and white honeysuckle (sometimes called the woodbine) that grows throughout the eastern states is a native of the British waysides and hedgerows. Another well-known variety, the evergreen or trumpet honeysuckle that bears scarlet or yellow blossoms in the spring, is a North American plant. Especially beautiful is the Japanese honeysuckle that opens its buds as daylight fades and with its delicious fragrance woos the large sphinx moths to drain its deeply hidden nectar. Certain other species—among them the winter-blooming honeysuckle of China, and the bush honeysuckle of North America—are dwarf shrubs rather than vines. To this group belongs also the twin honeysuckle that grows in moist cool woods from Pennsylvania to Michigan; it is a shrubby bush from three to five feet tall, with yellow funnel-shaped blossoms that grow in pairs.

The pink and clammy azaleas, though often called wild honeysuckle, belong to quite a different family, as does the columbine, to which also the name honeysuckle is improperly given.

Scientific name of yellowish white honeysuckle, *Lonicera caprifolium.* Flowers long, tubelike, borne in terminal whorls above united pair of leaves; calyx small, 5-parted; corolla long slender, with 4-lobed upper lip and narrow downward-curved lower lip; 5 stamens and 1 protuding style. Stem smooth, climbing. Leaves, upper pairs united around the stem, lower leaves opposite but not united. Fruit clustered red berries.

HONG'KONG', CHINA. In less than a century the island of Hongkong, England's first outpost in China, has been transformed from a desolate nest of pirates into one of the most important business centers in the world. Lying at the mouth of the Canton River, on the southeast coast of China, this island with its series of magnificent natural harbors is the great clearing point for the commerce of the Far East. Ships flying the flags of all the western nations there mingle with Chinese junks, Malay proas, and other strange craft of the Orient. The number of vessels, big and little, going in and out of this port is probably greater than anywhere else in the world; and their cargoes include tea and silk, sandalwood and ivory, opium and betel nut, coal and kerosene, as well as the more prosaic wares of the Occident.

PART OF HONGKONG'S BUSINESS SECTION

The great British seaport of Hongkong boasts of a business district of which London or Paris might be proud. If you did not see those coolies in their wide hats, you would never dream you were in China. Notice how the buildings project over the sidewalk, providing shelter against the hot sun and the downpours of the rainy season.

The center of this thriving commerce is the settlement at the northwest corner of the island, officially called Victoria, but better known to sailors the world over as the city of Hongkong. Its streets rise terrace upon terrace up the sides of Victoria peak, which dominates the main harbor from a height of 1,825 feet. From this peak can be traced the fine military highway, 22 miles long, which encircles the island. Here and there on the rocky cliffs are placed batteries of frowning guns. Across the mile-wide strait is the Kowloon peninsula, jutting out from the mainland, which also forms part of the British colony of Hongkong. Everywhere along the shores of bays and inlets you see strings of houseboats and rafts where live the Chinese "floating population"—for it is a remarkable fact that nearly 60,000 inhabitants of Hongkong live in such habitations.

Hongkong island, which is 10 miles long and 2 to 5 miles wide, was ceded to Great Britain by China in 1842 following the Opium War. The Kowloon peninsula was added in 1861, and in 1898 Great Britain obtained a 99 years' lease to 376 square miles of agricultural lands stretching along the coast back of Kowloon.

The colony is ruled by a British governor and an executive and legislative council. Hongkong has a university and numerous schools for Europeans, Chinese, and East Indians. The chief industries are cotton-spinning, sugar-refining, ship-building, rope-making, and stone-quarrying. Important fisheries are established on the mainland. Hongkong is also the headquarters of the China squadron of the British navy. Population: Chinese, about 548,000; non-Chinese, about 15,000.

HOOKWORM. One of the great enemies of mankind is the hookworm, which infects more than half of the people of the warmer regions of the world—a quarter of the world's population. In many countries over 90 per cent are infected; in the southern United States, 3,000,000 of people.

"Hookworms! What kind of monsters are they?" you ask. About the size and shape of a half-pin, pointed at both ends. The head end is hooked, and anchors the hundreds or thousands of small parasites into the soft lining of the intestine of man. The many small wounds thus produced usually cause loss of blood, with emaciation, "laziness," and general inefficiency. Children remain undeveloped and in some cases a person of 20 looks like a stunted child of 12 or 14. The weakened condition of persons infected with hookworm makes them especially susceptible to tuberculosis and other germ diseases.

The young hookworms live in soil which has been polluted and infected by the intestinal waste from persons suffering from hookworms. They enter through the bare feet, get into the blood stream, and pass by way of the heart and lungs to the intestine, where they lodge, grow, and mature. Their eggs pass from the intestine with the waste, to infect new places and other people. A simple, inexpensive, speedy, and efficient method of treatment has been used by physicians for some years. There are two slightly different species of hookworm, belonging to the *Nemathelminthes* or roundworms.

HERBERT HOOVER
The Great Food Administrator of the World War.

HOOVER, Herbert Clark (1874–). At the beginning of the World War, in 1914, the name of Herbert Hoover was known only to a few persons as that of a remarkably successful mining engineer. At its close little children had learned to lisp his name in every land of Europe, as well as in the United States and he stood out with General Pershing and President Wilson as one of the three greatest Americans called forth by the world conflict.

Hoover's war services began in 1914 with his organization of a committee in London to care for Americans who were stranded abroad by the outbreak of hostilities. When Belgium was threatened with starvation, following the German occupation, Hoover organized the Commission for Relief in Belgium (the famous "C.R.B."). It was financed by Belgian, British, and French subsidies, and by private contributions; and the United States government advanced vast sums to carry on its humane activities. It grew from nothing but the promises to pay of Hoover and his friends, until it had a fleet of over 70 ships and was spending $17,000,000 a month. For four years not less than 8,000,000 people in Belgium and occupied France were not merely fed and clothed, but saved from actual starvation and death, by this commission.

When Germany's submarine sinkings forced the United States into the war and made food a main issue, President Wilson called Hoover to Washington and made him Food Administrator (August 1917). His work in this position, with his slogan, "Food will win the war," is remembered in every household in the land. After the armistice he went to Paris as the administrator of a large fund appropriated for feeding the war-torn lands of Europe, and as a member of the Supreme Economic Council of the Allies. Between December 1918 and June 1919 about 20 countries—including Belgium, northern France, and practically all of Europe east of the Rhine—received food and other aid, including assistance in the rebuilding of industries, the organizing of a basis of exchange between countries whose currency systems were disrupted, and the care and exchange of prisoners. Over three million tons of food and other supplies, valued at $770,000,000, were distributed by him, chiefly to suffering women and children.

Herbert Hoover was born in West Branch, Iowa, in 1874, the son of a man who was both a farmer and the village blacksmith. His parents and relatives were all strong in the Quaker faith. The father died when Herbert was four years old, and at eight he lost his mother. After some years spent with uncles and aunts in the West, he was sent to Oregon and found a home with other relatives at Newberg. Here he formed an ambition to be a mining engineer, and at 14, when his relatives wished to put him in an orthodox Quaker institution, he declared his intention to attend a "scientific university." So to Portland he went, worked hard, saved, and studied for his university career.

In the summer of 1891 he entered Leland Stanford Junior University from which he was graduated in 1895. After working a year as a miner he obtained a position with a mining engineer, and it was not long before he was executing important commissions. From 1902 until 1914 Hoover came and went the world round, from mine to mine, with ever-growing reputation as an organizer of industry and an expert in metallurgy. China, the Malay Peninsula, Korea, Central and South America, Australia, Russia, and the United States shared his attention. When the outbreak of war in 1914 completely altered his work, he gave up a private business in which 150,000 men were working under him.

So great was his reputation as an able business man of high principles and skill in handling the greatest problems that he was seriously considered for the Republican presidential candidate in 1920. It was with general popular approval that President Harding made Hoover Secretary of Commerce.

HOPS. When the green conelike blossom clusters of the hop vine take on a yellow tinge and rustle like paper flowers, the hop-grower rushes his pickers into the field, for the value of his harvest depends on gathering this flower-fruit in the "nick-of-time." The yellowish aromatic resinous substance called "lupulin," which is contained in the fruit, deteriorates rapidly, and it is this substance which gives hops their medicinal and industrial value.

The hop is a perennial climber which each year produces several twisting stems that reach a length of 15 to 20 feet. It will not grow horizontally, but clings without tying to upright wires or poles. Hop fields, therefore, are provided with high trellises, so arranged that the vines may be let down for convenience of the pickers. It is a curious fact that hop vines always twine in a right-handed spiral, in the same direction the hands of a watch move.

There are male and female plants, but the best hops come from fields where only female plants are grown. This prevents seed production, which would detract from the value of the fruit. Plants grown from seed are not "true to type." For commercial purposes, therefore, hops must always be propagated by root cuttings or by sets.

Since the principal use of hops is in making beer, hop growing is carried on most extensively in Germany and Central Europe, where beer is the commonest beverage. The Bohemian hops are particularly noted for their excellence. England, France, and Belgium also produce large crops. The principal hop fields in the United States are in New York state and on the Pacific Coast.

The hop belongs to the nettle family. Leaves heart shaped, 3 to 7-lobed; flowers in panicles. Scientific name, *Humulus lupulus*.

HORN. There are two kinds of horn, one the continued growth of the actual bone structure, the other a hardening of the epidermis or outer layer of the skin. Corns that grow on our toes when we wear tight shoes, the hard spots on a camel's knees, the tortoise's shell, the scales of snakes and lizards, birds' beaks, horses' hoofs, the horns of sheep and cattle, and the finger and toe nails of man and animals, are examples of the latter, which is the true horn substance. It is closely related in growth and composition to hair, and is made up of about 50 per cent of carbon, with hydrogen, oxygen, nitrogen, and sulphur.

The deer's "horns," or "antlers," are examples of the other sort of "horn," which is really a bone outgrowth. During their growth period such "horns" are covered with a sensitive velvety skin, which later peels off, leaving the long, hard, solid antlers; these are usually shed once a year.

Beneath the sheath of true horn in the case of oxen, sheep, and antelope we find frontal bone outgrowths constituting a sort of core. Except for those of the pronghorn antelope, such horns are never shed. Neither are those of the giraffe and rhinoceros, which are thickened hardened masses of skin and hair, covering independent bones. Horns may be either solid or hollow; in the latter case they are generally found on the female as well as the male.

Early man used horn for weapons, handles, drinking cups, etc.; then for musical horns, powder horns, and the like. Since true horn can be softened and split into thin sheets which are tough, pliable, semi-transparent, and easily molded, many articles both useful and ornamental have been made from it. By a dexterous mixing of dyes, common horn can be made to look like expensive tortoise shell. Formerly thin horn plates were used in window panes, lanterns, and for similar purposes. Horn is still used in making combs, buttons, the handles of umbrellas, canes, knives, forks, spoons, etc.

HORN, MUSICAL. The horn is a gallant instrument. From its very beginning it has had to do with soldiers and warfare; it has been the companion of brave knights, and has brought timely aid to many a hard-pressed warrior.

The first horns used in music were rams' horns. From these natural hollow tubes it was a short step to hollow tubes of brass. In time these were improved by the addition of valves, worked by keys that shortened or lengthened the tube, thus making it possible to produce any note of the scale. By varying the shape and width of the tube, of the mouth-piece, and of the bell (the flare at the end), various types of horns have been developed.

In the modern orchestra only the French horn is technically called a "horn." The trumpet, cornet, and trombone are spoken of as "trumpets." The powerful tubas are the tenor and bass instruments of the brass group. The saxhorns, which are chiefly used in military bands, are keyed instruments with long winding tapering tubes, made in several sizes. They get their name from a Belgian, Adolphe Sax, who invented them. The euphonium is a small bass instrument of the saxhorn type.

Each of these instruments has its own interesting history and its own distinctive quality. The French horn gets its graceful shape from the fact that it was once a hunter's horn. Straightened out, it is from 7 to 10 feet long. Imagine a hunter riding to the chase with such an incumbrance! The tube of the horn was bent in a circle large enough for the hunter to slip over his head, and in this way he carried it to the chase.

The trumpet's brilliant and penetrating voice is due to its long narrow tube, 8 feet in length; it is only three-eighths of an inch in diameter until within 15 inches of the bell. This tube is usually bent back upon itself to make it more convenient to handle. The circling or bending of a tube makes no difference in the tone, so long as the air space inside is undisturbed. The trumpet is very difficult to play and therefore the cornet usually takes its place.

The cornet is the smallest of the brass instruments generally employed, for its 4-foot length is bent into a short space. For all its small size, it is the most important member of most brass bands, and fills a useful place in the orchestra. Its characteristic feature is its three pistons, which vary the length of the vibrating air-column and thus enlarge its compass.

The sliding trombone is the curious instrument that the performer plays by reaching out and drawing in his arm, as he lengthens and shortens its tube to make the different tones; for, in place of keys, it is fitted with overlapping slides.

THE TRUMPET ECHO OF THE CENTURIES

This painting by Sir John Gilbert shows a cavalier sounding the war trumpet. To the ear of the historian that trumpet call goes echoing down the centuries to the time of the Romans; for the cavalry trumpet you see here was simply the cavalry trumpet of the Romans in another form.

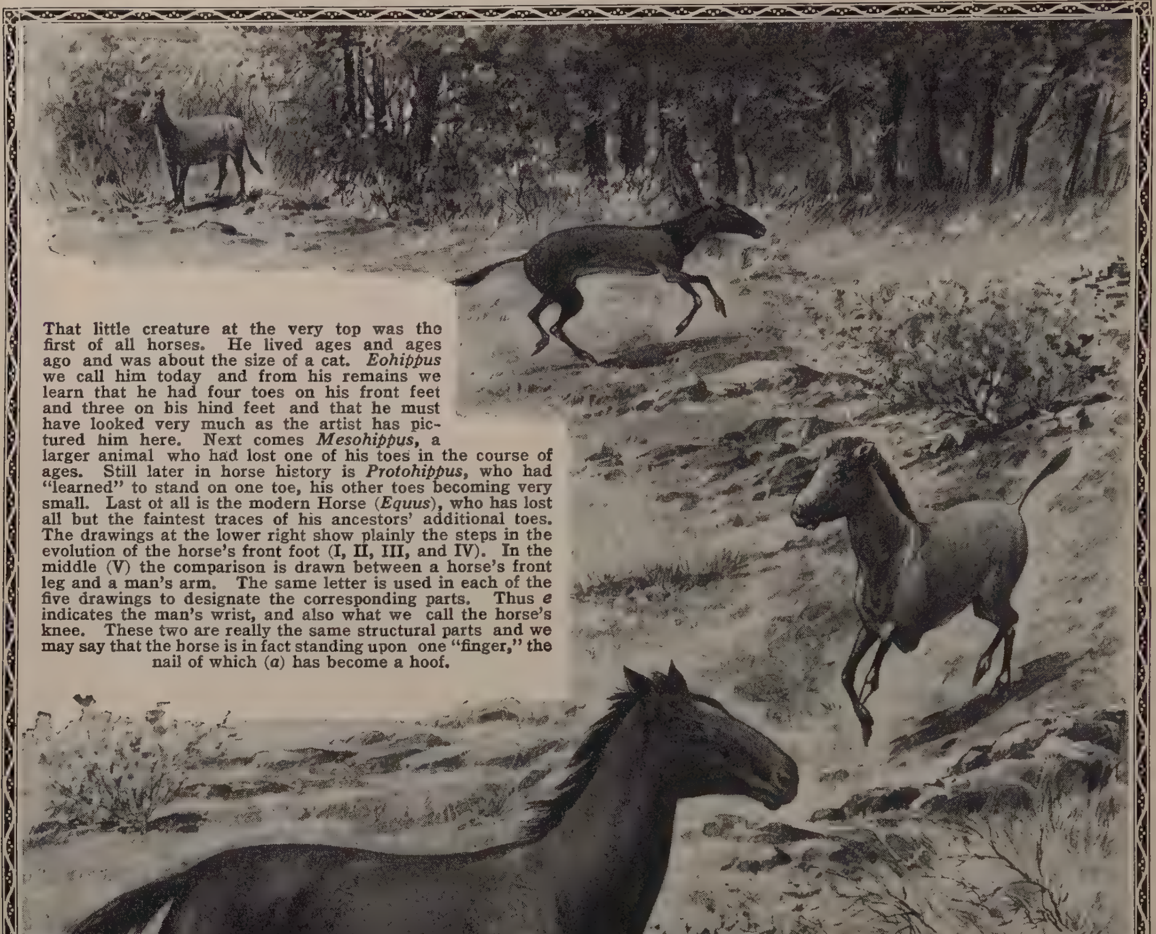
Although the tuba is the deepest voiced of all the brass instruments, it produces rich tones and its great voice can be made both soft and sweet. Its long cone-shaped tube is bent and rebent before it finally ends in the great flare that gives it such a look of weight. Like the cornet, it is played by valves.

The saxophone, an invention of the same man who invented the saxhorns, is a strange instrument of brass fitted with a mouthpiece containing a reed, like the clarinet. It is one of the important instruments of the military band, and is often employed in modern popular music because of the laughable effects that can be produced with it. (*See* Musical Instruments; Orchestra.)

HORNBILL. Great beaks, surmounted by bony crests or helmets, and prominent eyelashes distinguish these queer bulky birds (*Bucerotidae*) of Africa and the Malay region. Their food consists mainly of fruit and insects, but those of the larger species (about four feet long) kill and devour the largest and deadliest vipers. The hornbill breeds in holes in trees, plastered up with mud by the male until only a small window remains. Through this he passes food to the female and young.

HORNET. Several large members of the wasp family are called hornets. They are social insects, building nests of paper-like pulp. Their thick bodies are usually black or dark brown, marked with brilliant white or yellow, which has earned for some of them the name "yellow-jackets." If their nests are attacked, they show a disposition so irritable and wield a sting so painful that they fully justify the common expression "as mad as a hornet." If left alone, however, they are interesting and industrious workers. They do some damage to fruit, but make up for it by the harmful insects they kill. (*See* Wasps.)

THE HORSE AND HIS GEOLOGIC ANCESTORS



That little creature at the very top was the first of all horses. He lived ages and ages ago and was about the size of a cat. *Eohippus* we call him today and from his remains we learn that he had four toes on his front feet and three on his hind feet and that he must have looked very much as the artist has pictured him here. Next comes *Mesohippus*, a larger animal who had lost one of his toes in the course of ages. Still later in horse history is *Protohippus*, who had "learned" to stand on one toe, his other toes becoming very small. Last of all is the modern Horse (*Equus*), who has lost all but the faintest traces of his ancestors' additional toes. The drawings at the lower right show plainly the steps in the evolution of the horse's front foot (I, II, III, and IV). In the middle (V) the comparison is drawn between a horse's front leg and a man's arm. The same letter is used in each of the five drawings to designate the corresponding parts. Thus *e* indicates the man's wrist, and also what we call the horse's knee. These two are really the same structural parts and we may say that the horse is in fact standing upon one "finger," the nail of which (*a*) has become a hoof.

In very ancient times, all four-footed animals were "plantigrade"; that is, they walked upon the whole soles of their feet with their heels touching the ground as men and bears and elephants do today. In the course of time however there developed animals who "got up on their toes" in the manner of the horse illustrated here. Such "toe-walking" (digitigrade) animals, including creatures like deer, rabbits, mice, etc., and beasts of prey of the cat and dog tribes, became much swifter of foot and were better able to escape their enemies or overtake their prey. Thus they survived in the struggle for existence, while the "plantigrade" creatures, except those of great strength like the bear and the elephant, or of great intelligence like man, perished in the struggle for existence.

OUR SAGACIOUS COMRADE *and* HELPER, *the* HORSE

HORSE. The beautifully proportioned form of the horse and its intelligence, docility, and affection have made it man's best-loved animal friend, with the possible exception of the dog. From the earliest times of man's history we know that he used the horse, first as a source of food and later as an aid in war and a beast of burden.

The horse and other members of the horse family, the ass and the zebra, are also especially interesting because scientists have been able to trace their history more completely than that of any other animal group. So many fossil skeletons of horses have been discovered, in all parts of the world, that we know the history of its development for a vast period of time—some say as long as 2,000,000 or 3,000,000 years. We know that the remotest ancestral horse was a tiny animal about the size of a cat, with five toes on each forefoot and four on each hind foot. Fossil remains of early horses (named *Eohippus*, or "dawn horse") have been found in Wyoming and New Mexico, with four complete toes on the fore feet and three on the hind. As we follow down the series of fossil skeletons, we can see these little animals took to running on the tips of their toes to escape their enemies, and how gradually they came to throw more and more weight on the center toes. With each generation, therefore, these toes became stronger and the unused toes became weaker and finally disappeared (*see* Evolution; Foot).

That is why the horse now has only one toe on each foot. The hoof which encases it is just a greatly enlarged and thickened toe-nail. Traces of two of the lost toes may be found in the splint-bones which grow on either side of the cannon-bone of the feet. The upper joint of the toe has also become much larger and stronger. It is known as the "fetlock." The joints that are usually called the knees of the horse correspond to the ankles and wrists of a human being. The true knees and elbows are concealed within the body of the horse but they may be seen clearly when it is in motion.

The horse has a symmetrical form, strong limbs, a long head with large lustrous eyes, small pointed ears which it can move, and wide-open dilating nostrils. The neck is long, the body rounded and fleshy; the hair is soft and short, and lies close to the body, growing into long coarse strands in the mane and tail. The mane falls in graceful waves down one or both sides of the neck and over the face. The tails of the ass and the zebra are tufted at the ends, but in the horse the long hairs grow from the base and sides as well as from the tip.

The horse eats grass and grain but does not chew the cud. It has from 36 to 40 teeth—three incisors, or cutting teeth, and six grinders on either side of both jaws. In addition to these the males have four small canines, or dog-teeth. Between the canines and the grinders there is a space where the bit is placed, an arrangement by which alone man has been able to subdue this vigorous animal.

The colt is born with its eyes open and its body fully covered with hair. It is able to stand and walk a few minutes after birth. Within two weeks the "nippers," or central teeth, make their appearance. Other teeth soon follow and when the colt is about six months old it has a full set of milk-teeth, which it begins to shed during its third year. The dog-teeth, or canines, make their appearance, but only in the males, during the fourth year, and when the colt is five years old its set of permanent teeth is complete. The growth and changes in appearance of the teeth are so regular up to the tenth year that the age of the horse may be judged by them, but after the tenth year these annual changes cease. During its second year the colt's hair loses the curliness which distinguishes its first season, and becomes more lustrous. The hair, except the mane and tail, is shed annually in the spring. In the fall it grows longer and forms a warm winter coat.

ONE OF THE FAMOUS SHIRES

The Shires, whose native home is in the heart of England, are the largest of all horses. They have a heavy covering of shaggy hair from the hoofs to above the knees.

From the piles of horse-bones found in the haunts of the early cave men we know that the wild horse was first pursued for food. As a tamed servant of mankind the horse was unknown to Egypt of the Pyramid Age (3000–2500 B.C.), and to the Babylonians before 2100 B.C. The first to tame the horse were Aryan (Indo-European) peoples who inhabited the vast grass-lands that stretched north of the Caspian and Black seas.

All the early monuments and records indicate that for many centuries the horse was used chiefly to draw chariots in war, and was not ridden. As beasts of burden the ox and the ass were used long before the horse.

Several species resembling the horse and the ass are still found wild in central Asia, such as the "kiang" and "onager." Zebras and wild asses are also found in Africa, in the deserts of Syria and Persia, and in the central plains of India. (*See* Ass.) When white men first came to America the horse was entirely unknown to the natives and increased their awe of the newcomers. The wild horses later met with in South America and the mustangs or Indian ponies, which until quite recently ranged wild over a great part of western North America, are descendants of tamed horses that escaped from the Spaniards in the 16th century. Likewise, the wild horses of Australia are descended from stock imported from Europe.

By careful breeding and crossing of the different stocks, a great many varieties of horses have been produced, ranging in size from the London cart horse, which attains six feet, sometimes seven feet, at the withers, or highest point of the shoulder, to the Shetland pony, which sometimes is less than three feet in height. There are three main types of horses: the heavy draft horses; the tough, shaggy varieties; and the slender rapid travelers.

THE TINY HORSES FROM THE FAR NORTH

We'd be very glad to wear our hair long like that if we were Shetland Ponies and lived up on those cold islands off the northeastern coast of Scotland. In warmer climates Shetland ponies do not grow such thick shaggy coats.

Most of the ordinary horses of northwestern Europe are descended from the ancient dun-colored Norse horse. The ancestors of our modern draft horses were first bred as war horses, because a very large and powerful animal was needed to carry the huge weight of a mail-clad knight. Varieties from France, Bel-

A FAMOUS RACE HORSE

This is the famous race horse "Man o' War." Notice his fine, clean, lean head and his long muscular neck.

gium, and Germany were long ago imported into Great Britain, where some of the most famous modern varieties originated, such as the Cleveland Bay, the Shire, and the Clydesdale. The Shire, which has been bred for centuries, is of immense weight — from 1,800 to 2,200 pounds — with a plentiful covering of long hair extending around the front of the short stout legs. The magnificent Clydesdale, a Scottish breed named from the valley of the Clyde, not quite so large, is noted for its activity, strength, and endurance. The Percheron, a carefully bred French variety noted for its strength and endurance, is the most popular draft horse in America.

Those Dear Little Shetland Ponies!

The Shetland pony is a diminutive creature, a product of the cold, barren Shetland Islands off the northern coast of Scotland. Its small size is doubtless due to generations of battling against adverse physical conditions in its native haunts. It possesses great strength for its size, will fatten on almost any kind of food, and is patient and gentle. It possesses a fine head, a long shaggy mane, and a beautiful bushy tail.

The Arabian steed is the ideal horse. It is noted for its fleetness, its graceful proportions, and its intelligence and docility. The Arab loves and fondles his horse as he does his child, and man and beast understand each other perfectly. The owner of a brood mare carefully selects for her as a mate a stallion of unblemished descent. The mare and colt live in the tent with the Arab and his children. Marvelous stories are told of the devotion to each other of the Bedouin and his steed.

It has lately been shown that the original home of the Arabian horse was not the country for which it was named. The Arabs used no horses until after the Christian era. The Egyptians, however, as early as 1500 B.C., possessed horses which appear to have resembled the modern Arabian horses, while those that appeared in Babylonia, Palestine, and Greece about that time were coarse thickset animals. Classical literature, moreover, proves that about 1000 B.C. North African steeds were highly esteemed and eagerly sought for by the nations of the Mediterranean area, among whom they were famous for swiftness of foot. The Barb from Morocco is perhaps as famous as the Arab itself, and the historically noted Irish hunters were derived from Spanish horses of Barb descent.

The thoroughbred running race horses are descended from the Arabian and the Barb and are carefully bred for speed. The marvelous improvement in this direction indicates what can be accomplished by proper selection in breeding and systematic training. Trotting horses bred for speed are an American development. In 1818 the highest speed of a trotting horse was about one mile in 3 minutes. In 1859 this had been reduced to 2:19¾, and at the present time the record is under two minutes. The pacing record is lower still. These records were all made by American horses.

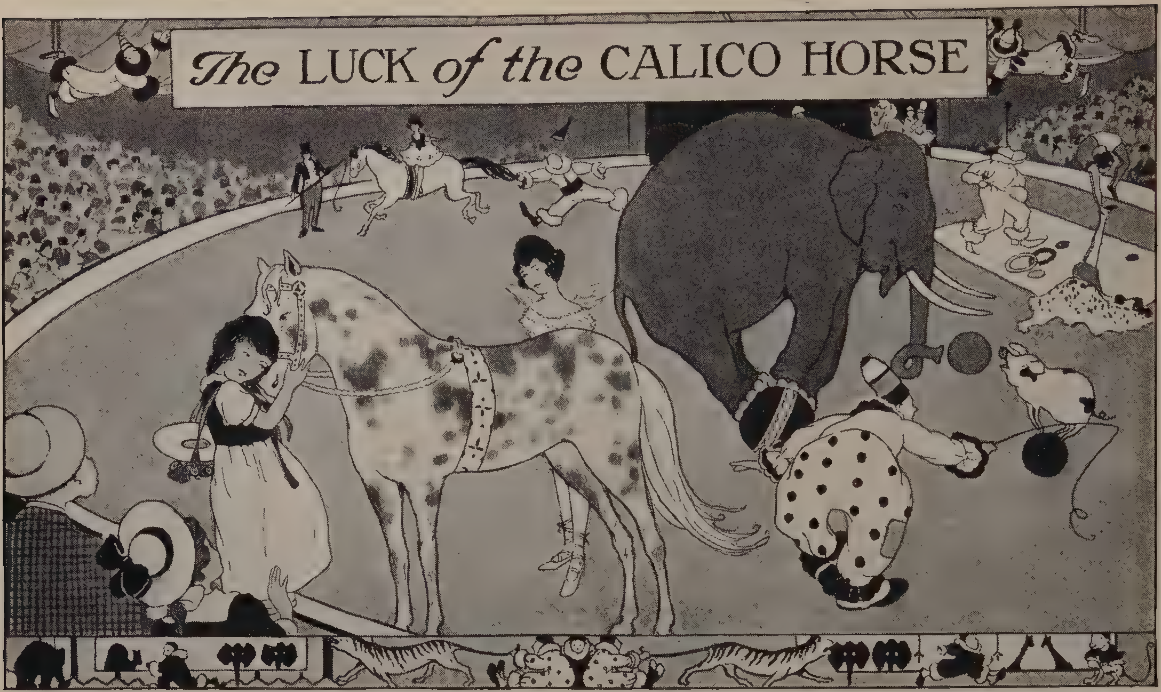
Except in the extreme Arctic regions, the horse is distributed throughout the world. Since the introduction of motor vehicles the number of horses in the United States has not increased as rapidly as in former days. Iowa, Nebraska, and Illinois are the banner states for breeding farm horses.

Scientific name of horse family, *Equidae;* of the domestic horse, *Equus caballus.* Normal life, 18 to 20 years. The molars are peculiar in that they grow up from the gums as fast as they wear off on the crowns, which are very long. The grinding surface is ridged by valleys filled with dentine and "cement."

THE ARAB AND HIS BEST FRIEND

This is an African Arab mounted on one of those Arabian horses, famous for their speed and endurance. The Arab looks upon his horse almost as a member of his family.

The LUCK of the CALICO HORSE



"Suddenly, above all the fun, a little girl's clear voice was heard, 'O papa, O mama, I do believe that's Pumpkin Pie!' Ali Baba pricked up his ears and whirled around. Then he trotted over to a box and poked his nose into the face of the little girl who had loved him on the farm."

THIS is the story of a horse that was like the Ugly Duckling in the fairy tale. People laughed at him or pitied him for a long time, but by and by they saved up their quarters and half-dollars and paid to see him.

When his mother, a handsome sorrel, had this new baby the farmer's family went out to the pasture to see him. The farmer's little daughter was so puzzled that she asked: "Which is it, papa, a colt or a calf?"

For the baby was a piebald or "calico" horse. He was creamy white all over, except where he was splashed with sorrel. And everybody knows that no proper horse is as spotted as a red and white cow! The farmer thought it did not matter what such a horse was named, so he called him "Pumpkin Pie."

How Pumpkin Pie Joined the Circus

It was soon plain that Pumpkin Pie never could be of much use on the farm. He had such small hoofs and slender legs that he could not pull a plow or heavy loads. He might have made a good buggy horse, for he could travel fast and was as gentle as a lamb. But no one likes to be asked if he has not made a mistake and hitched up the cow! Besides, he was so nervous and scary that it really was not safe for women and children to drive him. So Pumpkin Pie was allowed to spend most of his time in the pasture. He and the little girl were great friends. She fed him apples and stroked his nose.

One day when Pumpkin Pie was four years old, a circus came to the nearest town. The owners wanted hay to feed the horses, camels, and elephants. The farmer hitched up Pumpkin Pie with three other horses to haul a big load of hay to the circus.

The brass band, the shouting men, the flapping white tents, the red and gold wagons and cages, and the strange animals scared the poor calico horse almost to death. He reared and strained and plunged and snorted; his eyes bulged and turned red with terror.

Then suddenly he became quiet, and stood trembling. A little circus lady who rode horses and loved them had come out of her dressing tent to see what was the matter. She stood at his head and stroked his white velvet nose, and talked baby talk to him.

"Bless him, and was he scared? Zaidee wouldn't let old elephants and red wagons bite him. No she wouldn't!"

She popped a lump of sugar into his mouth and petted him. She noticed his small head and arching neck, his little hoofs and slender legs. Many show people think a "calico" horse brings good luck. In just five minutes that lady bought the horse.

"His name is Pumpkin Pie," said the farmer with a grin. "What are you going to use him for—a four-legged clown?"

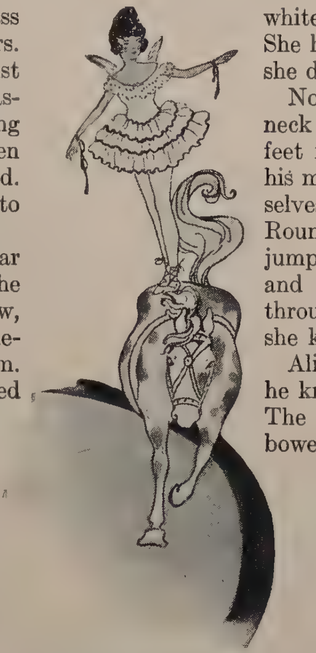
She shook her head. "Come to the show next year," she said, "and see him."

Ali Baba and Mademoiselle Zaidee

So poor despised Pumpkin Pie belonged to Mademoiselle Zaidee, the lady bareback rider. She named him Ali Baba for the poor woodcutter in the 'Arabian Nights', who found out the secret of the forty thieves.

That winter Ali Baba lived in a big training stable and yards in the South. He was fed and exercised and groomed but he had lessons to learn. He was taught to march in procession with a brass band and all the animals and performers. He was taught to gallop around a sawdust ring and obey every order of the ringmaster's cracking whip. He got used to seeing elephants stand on their heads, and men and women swinging in trapezes overhead. He loved the funny clown. He learned to change his step and keep time to music.

Every day he spent hours with his dear mistress, learning all the pretty things she wanted him to do. He was plump now, and had a nice, broad flat back. Mademoiselle Zaidee never put a saddle on him. She sat and stood and danced and leaped on and off his bare back, while he galloped around a ring with the easy motion of a rocking chair. When Ali Baba did very well she gave him sugar.



"Round and round rocked Ali Baba, while his mistress leaped on and off his back."

In the spring the circus went on the road. By and by it came back to the town where Ali Baba's mistress had bought him. When the big three-ring tent was full of people, and the band began to play, the procession marched in and around the middle ring. At the head of all, Ali Baba waltzed to the music with Mademoiselle Zaidee dancing on his back.

Ali Baba was just as spotted as ever, but among all the other queer circus animals he looked just right. Indeed, he was beautiful. His coat glistened like satin. His long tail and mane fell in white cascades. His hoofs were polished and fitted with silver-plated shoes. He had a silver bit. His bridle was braided of white silk cords. His mistress was dressed in white satin and tulle and silver spangles. She had silver wings on her shoulders, and she danced like a fairy.

No wonder Ali Baba arched his slender neck with pride and flung out his dainty feet in time to the music. Then he and his mistress had the middle ring to themselves. The music went faster and faster. Round and round rocked Ali Baba. He jumped hurdles. His mistress leaped on and off his back. She made flying leaps through paper hoops. When it was over she kissed her hands to clapping people.

Ali Baba bobbed his head, to show that he knew the clapping was partly for him. The clown pretended it was for him, and bowed and smiled. Then Ali Baba pushed the clown back and the people shouted and stamped their feet in glee. A bouquet was flung. He picked it up with his teeth and gave it to his dear mistress. Suddenly, above all the fun, a little girl's clear voice was heard, "O papa, O mamma, I do believe that's Pumpkin Pie!"

Ali Baba pricked up his ears and whirled around. Then he trotted over to a box and poked his nose into the face of the little girl who had loved him on the farm. The people clapped and cheered, and Mademoiselle Zaidee lifted the little girl to Ali Baba's back and the horse rocked around the ring with his old playmate.

HOSPITALS. Sick people—*really* sick people—are lucky today if they can be cared for in a good hospital. There they can have the expert care of the best physicians and surgeons, trained nurses in attendance when needed night or day, all the discoveries and appliances of modern science and skill to find out what the matter is and put it right, a specially trained dietitian to see that they have the proper food—in short, every comfort and care needed to give the best chance for recovery. Money cannot put into the most luxurious home the facilities for scientific care which the poorest can get in a good hospital.

The principles of modern hospital organization had their rise, through the genius of Florence Nightingale, out of the ghastly sufferings of the Crimean War, as did the profession of nursing, without which the modern hospital could not exist. A few years later the chemist Pasteur discovered the relation of germs to putrefaction, and the great surgeon Lister, applying Pasteur's discoveries to surgery, revolutionized operating room practice by the use of antiseptics. Almost every year since then has seen some advance, great or small, in medical science and hospital practice. And all of this is available to the poor as well as the rich. When a great English surgeon, famous for his practice in Guy's charitable hospital, wished to reassure the royal mother of one of his patients, he said: "Madam, his royal highness shall be as well cared for as if he were one of my patients at Guy's." More he could not say.

Most American general hospitals have, in addition to free wards, provision for paying patients in semi-private wards, and often luxuriously appointed private rooms. In the United States there are federal hospitals (chiefly for the army and navy), state, county, and city hospitals; public hospitals founded by private endowment; public and private hospitals supported by churches, industrial corporations, and fraternal and benevolent societies; and private hospitals run to care for the private patients of individual physicians and surgeons. The famous Mayo Clinic at Rochester, Minn., is a unique instance —originally a private clinic which, through the exceptional surgical ability and organizing genius of its two founders, acquired national and international reputation and was by them finally given to the state.

The United States has some of the finest hospitals in the world—and some of the worst. The American College of Surgeons has attempted to "standardize" American hospitals according to certain principles, of which the most vital are the following: adequate diagnostic laboratory facilities (because no patient can be properly treated until the doctor *knows* what is the matter); the keeping of adequate case records (because it is not possible to keep medical practice up to its highest level without proper "bookkeeping" on the treatment used and the results obtained); and prohibition of secret "fee-splitting" or division by the surgeon of his fee with the physician who sends a patient to him.

Several states now will not grant a license to practice to a medical graduate until he has spent a year or more as an "intern" in some recognized hospital, where he works under the supervision of the staff physicians and surgeons. Interns usually receive their maintenance but no salary, their services being regarded as a fair return for the educational value of the experience they gain.

Most general hospitals conduct training schools for nurses. A good hospital usually gives good training, but, in view of the difference in value of the training given by different hospitals—and particularly of the absolute worthlessness of training given by some so-called hospitals—it is wise to get very full information about a hospital from different sources before enrolling as a student (*see* Nursing).

Dispensary and outpatient work for patients not confined to bed is increasingly important in the general hospital. Pay clinics for people with small means who do not wish to be objects of charity have met a great need.

In addition to general hospitals, there are a number of hospitals devoted to special classes of disease, such as children's diseases, nervous and mental diseases, tuberculosis, cancer, etc. Sanitariums are for the residential treatment of chronic conditions.

HOUSTON, SAM (1793–1863). To Sam Houston more than to any other one person, the United States owes the possession of Texas, and Texas owes her independence from Mexico. He commanded the Texan troops at the battle of San Jacinto, Apr. 21, 1836, in which the Mexicans were defeated and the independence of Texas won. He presided over the convention which formed a constitution for the new republic, and as its president (1836–38, 1841–44), he worked unceasingly for its annexation to the Union.

Houston brought to his work qualifications which rendered him especially fitted to the task. Although born near Lexington, Virginia, he had removed to the frontier in Tennessee at the age of 13, and for several years lived among the Cherokee Indians, by whom he was adopted. In the War of 1812 he rose from private to lieutenant, and formed a lifelong friendship with General Jackson, under whom he served against the Creek Indians in the battle of Tallapoosa (1813). All this fitted him to understand the frontiersman of Texas. And his training as a lawyer after resigning from the army, his experience as Congressman from Tennessee, 1823–1827, and as governor of that state during the next two years, fitted him for his service as constitution-maker and president of the Texan republic.

When Texas was annexed to the United States, in 1845, she honored Houston by electing him senator, a place which he held until 1859, when he became governor. It was against his influence that Texas seceded from the Union in 1861; and when he placed his allegiance to the Union above his loyalty to his state, by refusing to take the oath to support the Confederacy, he was deposed from office. Houston did not live to see the Union restored.

HOUSTON, TEX. Looking at the map you would not perceive that Houston is a seaport, for it is situated on a little crooked black stream called Buffalo Bayou, running up from Galveston Bay, 50 miles to the southeast. The federal government has widened and deepened this channel, at a cost of six and a half million dollars, enabling large ocean steamers to reach Houston and thus making the city a great shipping port for cotton, cottonseed oil, rice, sugar, lumber, petroleum, and petroleum products. It is almost the most important railway center of south Texas, and one of the greatest manufacturing cities of the whole state. There are extensive railway car shops, cottonseed oil, petroleum, and sugar refineries, planing and steel rolling mills, flour and rice mills, grain elevators, wood-working plants, and brick and tile factories.

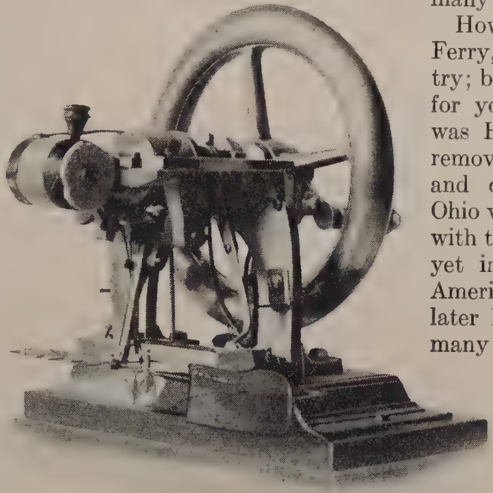
Houston was named in honor of Gen. Sam Houston, being settled soon after his victory at San Jacinto in 1836. Following the example of Galveston, Houston adopted the commission form of government in 1905. It is the home of Rice Institute, one of the important educational institutions of the South. Population, about 140,000.

HOWE, ELIAS (1819–1867). If the women of the world were to take a vote on the person who had done most to lighten their labors, the name of Elias Howe, the inventor of the sewing machine, would be on many ballots. Yet in his earlier years he was often derided, and his machine was denounced as the enemy of the very class whose toil it did so much to lighten. For years Howe struggled on in poverty, being unable to sell his machines; and when his invention was finally accepted "sewing machine riots" occurred among many of the workers who believed that the machines would take away their livelihood.

Elias Howe was born in Spencer, Mass., where he lived with his father until he was 17, working upon the farm and in his father's grist-mill, and attending the district school during the winters. As a boy he was frail in health and slightly lame; but his physical weakness was balanced by an extra share of Yankee ingenuity. When he was given a task it is said that he always spent more time in finding a better way to do it than in carrying out instructions. At 17 he left home to work in a factory for cotton machinery at Lowell. Later he worked in a machine shop in Cambridge, and then in Boston, where he married.

To eke out his salary of $9 a week, his wife sewed at home; and as Howe watched her stitching endless seams at night, he wondered if machines could not be made for sewing, as well as those for spinning and weaving, with which he was so familiar. In 1843 he began to work on his first model, and a year later he had completed a machine that would sew a fairly good seam. With money lent him by a friend he was able to perfect it and to obtain a patent. Then he tried to sell it. He pitted his stitcher against five seamstresses chosen for their speed, and they acknowledged that it sewed faster and better than all of them. Many people admired the ingenuity of the invention — but no one would invest a dollar in it.

THE FIRST SEWING MACHINE



That new suit of yours would have cost twice as much if it hadn't been for this little hand sewing machine which is now in the Patent Office at Washington. It is the model of the first sewing machine ever built.

Finally Howe tried to sell it in England, and succeeded in getting about $1,200 for his patent rights for Great Britain. After paying his debts he returned home penniless, to find that unscrupulous Americans had seen the value of his machine during his absence and that several imitations were on the market. He was forced to go to court to establish his rights in the invention, which were fully conceded in 1854. Then the money-making value of the sewing machine became apparent, and before Howe's death his royalties grew to $200,000 a year. He refused a renewal of his patent in 1867.

Howe was not merely an ingenious inventor but also a true patriot, serving as a private in 17th Connecticut volunteers during the Civil War. The hard life undermined his frail constitution, and he died in 1867. (*See* Sewing Machine.)

HOWELLS, WILLIAM DEAN (1837–1920). As "Dean of American Letters"—a title which he won in his later life through his long and distinguished services to literature—William Dean Howells was fond of recalling the days of his boyhood, when his father's printing-office was his school. His first attempt at literature, he tells us in his book of reminiscences called 'Years of My Youth', was not written but was set up directly in type and printed off.

Not counting these very youthful attempts as printer and journalist, but beginning with the publication of his first book, Howells' literary career covered a full 60 years. One of his first books was a 'Life of Lincoln' for the presidential campaign of 1860, and his literary activity continued unbroken up to the time of his death in 1920. He knew personally Longfellow, Hawthorne, and Lowell, in the golden age of American literature, and he outlived his friends Henry James and Mark Twain, and many lesser contemporaries.

Howells was born at Martin's Ferry, Ohio, of Welsh-Quaker ancestry; but the town which he described for young people in 'A Boy's Town' was Hamilton, to which the family removed while he was a lad. In these and other towns in the peaceful Ohio valley, he grew up in close touch with the quiet, simple, commonplace, yet interesting life of the average Americans of the Middle West, which later he depicted so realistically in many of his novels.

The very fact that Howells lived in the midst of this life might have prevented his seeing it in its true proportions, had he not had the opportunity of viewing it also from a distance. From 1861 to 1865 he was United States consul in Venice; and after his return to this country he was for a time on the staff of the *New York Times* and the *Nation*, and then removed to Boston, where for 15 years he was connected with the *Atlantic Monthly*, first as assistant editor and then as editor-in-chief. Returning to New York, he was associated with other leading American periodicals, chief of which was *Harper's Magazine*, for which he wrote 'The Editor's Easy Chair' from 1892 until the end of his life.

As a master of literary style Howells has few superiors. "For 40 years his English has been to me a continual delight and astonishment," Mark Twain once wrote; and another critic said, "He never wrote a bad page, never wrote a sentence that anyone else could make better."

As a novelist, Howell's strength lay not only in his easy style, but also in his fidelity to truth, the painstaking care with which he revealed the everyday life of the average American. He was a true realist, but unlike many of this school, he did not dwell upon the seamy side of life. Nor did he confine himself to novels, for he wrote a great number of amusing little farces, several volumes of verse, delightful familiar essays, books of travel, and much sound literary criticism. Not only in his writings, but through his fine sympathy and his sane and high-minded attitude toward literature and life, as critic and editor, as the friend and adviser of younger writers, he exercised a strong and wholesome influence on American literature. Although self-educated in the sense that he never attended college, he received honorary degrees from Oxford, Yale, Columbia, and

Princeton universities. He was president of the American Academy of Arts and Letters from its foundation in 1904, and in 1915 was awarded the gold medal of the National Institute of Arts and Letters "for distinguished work in fiction."

The following are a few of Howells' best novels: 'Their Wedding Journey' (1871); 'A Foregone Conclusion' (1875); 'The Lady of the Aroostook' (1879); 'A Modern Instance' (1882); 'The Rise of Silas Lapham' (1885); 'Indian Summer' (1886); 'A Hazard of New Fortunes' (1889); 'The Kentons' (1902).

HUDSON BAY. Away up in northeastern Canada, a huge blue patch on the map, lies the third largest land-locked sea in the world. This is Hudson Bay—a mighty gulf whose icy waters cover 500,000 square miles, reaching up north into the Arctic Ocean by means of the Fox Channel and Fury and Hecla Strait, and out east into the Atlantic through Hudson Strait, a deep gorge grooved out of solid rock.

It is a lonely sea—this "Mediterranean of the North"—for, although never entirely frozen over, it is so obstructed by drift ice that only during summer can boats safely plow its icy waters, where—

In the placid inter-ocean's swell
The white whales blow and the porpoises dwell;
And where the far north wind and sea
Chant dirges of eternity.

In the short open season the Hudson's Bay Company's steamers find their way up there to load with millions of dollars' worth of furs. Then too the Indians living in scattered bands near the shore venture out after the vast shoals of seals, porpoises, walrus, and whales, and fish for the cod, salmon, and many other edible fishes, while here and there steam whalers worm their way through ice floes, and Eskimos' skin kayaks shoot out on the water like sea birds.

Save for a few trading stations and scattered settlements, the low shores—low except for certain high bluffs on the east and northeast—are the haunts chiefly of caribou and musk ox, of ducks and loons and ptarmigan. But it is believed that the whole region—whose soil and timber and minerals have as yet scarcely been drawn upon—will open up when Canada's new route to Europe is opened. This route, which will be nearly 1,000 miles shorter than any other for shipping the grain and cattle of the northwest to Liverpool, involves dredging a deep harbor in the bay, and building a $6,000,000 railway.

Thirty rivers flow into Hudson Bay, the Nelson, the Churchill and the Severn being the most important. The bay is about 70 fathoms deep and contains several islands, the largest of which is Southampton Island at the north end. The entrance is so near the Magnetic Pole that the compass needle is unreliable. The Cabots entered Hudson Strait in 1498, and several Elizabethan mariners during the following century did likewise. The bay itself was not explored until Henry Hudson reached its southern limit in 1610.

HUDSON, HENRY (1575?–1611). In the year 1910, three centuries after the great English navigator Henry Hudson had discovered Hudson Bay, a strange, bright-colored vessel lay anchored in the Hudson River, opposite the city of New York. It was a reconstruction of the little ship *Half Moon*, in which Hudson had braved strange seas and treacherous ice, and had explored the river on which was to arise this shining city, now doing honor to his name in the splendid Hudson-Fulton memorial celebration.

The ship was like some strange outlandish bird among its sober neighbors, the swift motor launches and gray steamers of our day. It was itself hardly larger than a good-sized launch, and the main deck was raised only a few feet above the water, so that except on the smoothest days the men must have remained between decks. The stern of the vessel rose in a steep poop and the bow was raised in a curve like a half moon, from which the ship perhaps took its name. In the dark narrow space between the decks, where the men lived, there was not room to stand erect or even to lie at full length.

To visit this vessel was to understand something of the hardships and dangers endured by the old sea adventurers; and something too of the conditions which led to the mutiny by which Hudson met his untimely end in one of the saddest crimes in history.

We know nothing of Henry Hudson's life before his four voyages between 1607 and 1611. All of these were made for the purpose of discovering northeast or northwest passages to China, to reach the rich trade of the Orient. His first and second voyages were for the Muscovy Company, an English trading company. During the first he explored the coasts of Greenland and Spitzbergen. During the second he reached Nova Zembla, trying in vain to force a passage through the ice-locked Kara Strait.

The third voyage, for which the *Half-Moon* was built, was for the Dutch East India Company of Holland. During it he explored the great river which bears his name, with the vain hope that it might lead to the Pacific Ocean. The last voyage was for an English company formed especially for the purpose. Again in the *Half Moon* he set sail in 1610, passed through the strait which bears his name, and explored and charted Hudson Bay. Winter overtook him, and he and his men endured terrible hardships from cold and lack of food on this inhospitable shore.

Discontent and mutiny smoldered, and in the spring broke out in a flame. Hudson was overpowered and, together with his young son, the ship's carpenter, and several sick men, was cast adrift in a small boat. The boat was never heard from again, and we can only guess at its ultimate fate, and the tortured love of that intrepid father, as he saw his son sinking into that death which he too must face. The ringleaders of the mutineers were killed by the natives. Others won their way back to England with Hudson's records, and were there tried for murder.

Hudson's services were of inestimable value in extending geographical knowledge, and they also bore fruit in developing the rich fisheries of Spitzbergen and the fur trade of the Hudson Bay region.

HUDSON CAST ADRIFT TO PERISH IN THE ARCTIC

"Hudson's last voyage was for an English company. Again in the 'Half Moon' he set sail in 1610, passed through the strait which bears his name, and explored and charted Hudson Bay. Winter overtook him and he and his men endured terrible hardships from cold and lack of food on this inhospitable shore. Discontent and mutiny smoldered and in the spring broke out in a flame. Hudson was overpowered and, together with his young son, the ship's carpenter, and several sick men, was cast adrift in a small boat. The boat was never heard of again."

HUDSON RIVER. Fascinating legends, interesting stories of history, and picturesque scenery combine to make the Hudson River one of the most renowned rivers in the United States. The excellent harbor which its mouth affords has caused New York City to become the greatest city of the New World.

Rising in the heart of the Adirondacks in the northeastern part of the state, the Hudson is at first narrow, winding, and rock-obstructed, and then flows past wooded hills and cultivated slopes until it reaches tide-water at Troy. Here it is joined from the west by its chief tributary, the Mohawk. From Albany down it is like a long arm of the sea, broad, stately, and friendly. The Catskill Mountains, made famous by Washington Irving, rise in varied and mystic beauty on the west side of the river. Lower down the Hudson enters the Highlands, the scene of Arnold's treason and Andre's death, a region of ancient rock-ribbed hills and mountains. The United States Military Academy at West Point and the ruins of Fort Putnam are situated a few miles below. Emerging from the Highlands near Stony Point, where "Mad Anthony" Wayne stormed and captured the British stronghold, the river expands to form the Tappan Sea, near which was fought the Burr-Hamilton duel. The Palisades, a vertical wall of rock 300 to 500 feet high, majestic and awe-inspiring, extend for 20 miles on the west bank of the river reaching to the outskirts of New York City. The banks of the thronged waterway, once covered with forests, are now largely residential until the city's numberless docks and wharfs are reached and the river empties into New York Bay.

An Aid to Early Development

The Hudson River was first explored in 1609 by Henry Hudson, from whom it gets its name. In early days the name North River was often applied to it, in distinction from the Delaware or South River and this name is still given by New Yorkers to its lower part. Since the Hudson furnishes the only deep waterway through the Atlantic highlands open to large vessels, it greatly aided the early commercial and industrial development of New York. Before railroads were built it carried nearly all the traffic from the fertile country of the west and north. The first successful attempt at steam navigation was made by Robert Fulton on this stream, and with the opening of the Erie Canal from Troy to Buffalo in 1825 a continuous waterway connected New York City and the North Central states. Ocean-going vessels still travel up as far as Troy, where they are loaded with freight which has come by water from Duluth or other western points through the Great Lakes and down the Erie Canal. The falls and rapids furnish electric power which is used as far away as the coal fields of Pennsylvania.

HUDSON'S BAY COMPANY. Scattered over the vast northern regions of Canada, almost up to the shores of the Arctic Ocean, lie the fur-trading stations of the great Hudson's Bay Company. In those solitary outposts of civilization, which are still remote from the gradually extending transportation routes and where the sight of a new face is an event long to be remembered, agents of the company with their families live the same isolated lives which their predecessors have lived for more than two centuries. In the spring the Indians and half-breeds bring in the stock of furs accumulated by the winter's trapping, to barter for food, weapons, and clothing. These are then carried, in canoes or light-draft steamboats, to posts in Hudson Bay for transportation to England in the company's ships, or to railway terminals in the south, whence the furs go overland to some Atlantic port for shipment.

Boundless Wealth in Furs

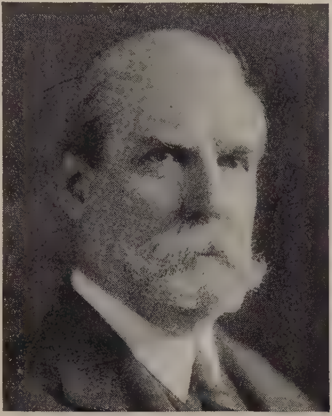
The early history of northwestern Canada is the history of the Hudson's Bay Company and its rivals. Their trading posts were the first settlements in the western plains, around which many a thriving city has grown. The Hudson's Bay Company dates from 1670, when Prince Rupert of England set about realizing the visions of boundless wealth inspired by the success of Pierre Radisson, a French Canadian adventurer who had, seven years before, brought to Quebec a cargo of 60,000 beaver skins, worth half a million dollars. With 17 associates the prince obtained from his uncle, King Charles II of England, a charter giving them the sole rights of trade in the unoccupied lands which drain into Hudson Bay. It was many years before men realized the vast extent of this grant. No one supposed it included a territory more than a few hundred miles in breadth, and years of exploration were necessary before it was discovered that "Rupert's Land" included nearly all of the present provinces of Manitoba and Saskatchewan, a large part of Alberta, and even certain territory now a part of the United States.

But vast as the company's holdings were, wealth did not come rapidly, at first, because the company had to contend with French rivals from Canada. With the acquisition of French Canada in 1763 this obstacle was removed, but a rival company—the Northwest Company—sprang up; and until the union of the two in 1821 their employees were sometimes engaged in actual warfare.

The Hudson's Bay Company had something more than mere trading privileges, for it owned the land and governed the people also. This arrangement was found intolerable when settlers moved into the region, and in 1869 the company was forced to surrender most of its privileges, though it was paid $1,500,000 and allowed to keep its forts and large tracts of land. It is today a wealthy trading corporation, with nearly 150 trading posts, although it no longer has the exclusive rights that it once claimed.

HUGHES, CHARLES EVANS (born 1862). A lawyer of national fame, governor of New York state, justice of the Supreme Court, and Federal secretary of state, Charles E. Hughes has been a national figure for many years. He was born in Glens Falls, N.Y., the son of a clergyman of Welsh descent. He received his A.B. from Brown University in 1881, then taught school while studying law, and going to New York City was graduated in law from Columbia University in 1884, being admitted the same year to the bar.

He first attracted wide attention in 1905–06 by the searching way in which he conducted the investigation for a committee of the New York legislature of the great insurance companies, in several of which scandals had become notorious. Before this Hughes had become a marked figure in New York state by a similar investigation of New York gas rates, then just concluded. He accepted the new commission on condition that he should be absolutely unhampered. His freedom from bias and his extraordinary capacity for analysis of monumental masses of detail, as well as for hard work—sometimes 20 hours a day—appeared in the results. Most of the recommendations made in the report he drafted were later enacted into law.


CHARLES EVANS HUGHES
Statesman and Reformer

Elected governor of New York state on the Republican ticket for two successive terms (1907–08, 1909–10), Hughes showed the same vigorous courage in forcing a reluctant legislature to pass various reform measures, which included an anti-race-track gambling law, a direct primary law, and particularly a law creating a public service commission, the outstanding achievement of his administration. He abolished "back stairs" influences, refusing private interviews to influential politicians; and "cleaned house" by eliminating honest but incompetent officeholders as ruthlessly as the corrupt ones, without regard to party services in either case. A firm believer in the party system, he was too honest, too uncompromising, and too deficient in the arts of popularity to become a party leader.

Governor Hughes resigned his office in 1910 to accept an appointment from President Taft to the United States Supreme Court—a position admirably suited both to his tastes and to his abilities. He ranked as one of the ablest men on the bench, and, so long as he sat there, he remained absolutely dissevered from politics.

It was undoubtedly much against his own inclination that he resigned his position on the Supreme Court bench to accept the Republican nomination for the presidency against President Wilson in 1916. The party platform was vague with reference to the war, and the campaign centered on bitter attacks on Democratic policies. Whether for this or for other reasons, many of Mr. Hughes' admirers felt that his campaign did not add to his reputation. He was defeated in November (*see* Wilson, Woodrow), and returned to the practice of law. In 1918 President Wilson appointed him to conduct the investigation of charges of extravagance and corruption in the building of airplanes for the army and navy.

In 1920 Hughes was favorably mentioned in many quarters for renomination, but for reasons of "political availability" he was passed by and Senator Harding nominated. After the overwhelming Republican victory, he was appointed secretary of state with universal approval, and from the beginning made a favorable impression by his able and conservative handling of the many difficult international questions with which he had to deal.

HUGHES, SIR SAM (1853–1921). As Canada's minister of militia and defense at the outbreak of the World War in 1914, Lieutenant-General Hughes raised and equipped for overseas service a very large part of the 600,000 men that Canada contributed in that gigantic conflict, and they were said to be among the best of all the British forces. A man of force and energy, he showed an ability in organization that amounted to genius. He recognized no obstacles, either for himself or others. If anyone complained that the task he set was impossible, his reply was: "Nothing is impossible. Do it."

Born on a farm in Ontario, of Protestant Irish stock, young Hughes enlisted in the militia in his 13th year, and at the age of 17 won a medal for service against the invading Fenians, who were seeking the overthrow of the British government in Canada. He was educated at the Toronto Normal School and Toronto University, and taught school for a number of years. Then he took up newspaper work, purchasing the Lindsay *Warder*, which he edited himself until 1897. In 1892 he was first elected to the Canadian House of Commons, and from that time he played a prominent part in public affairs. One of the principles he strongly advocated was that the Colonies should assist the Empire in time of war. During the South African War he offered his assistance in raising troops, besides serving in the intelligence and transportation departments. He was several times mentioned in dispatches.

Ever since his youth, he had made a special study of military affairs, and had risen in rank from private to lieutenant-general of militia. His political and military knowledge and experience fitted him for the office of minister of militia, to which he was appointed in 1911. In spite, however, of the splendid results he obtained as an organizer, and the esteem which he gained at first, his administration of the militia office was bitterly criticized. He was charged especially with being rash and arbitrary in his actions, and these attacks led to his resignation of his office in 1916. The British government rewarded him for his services by creating him a Knight Commander of the Bath.

TITANIC MASTER *of* FRENCH ROMANCE

Poet, Novelist, Patriot, Reformer

Here is a speaking likeness of Victor Hugo by one of the most famous of the French portrait painters, Bonnat. Grouped around him are some of the creations of his fertile brain: Quasimodo the hunchback, Esmeralda, Hernani, with Doña Sol, Gilliatt fighting the octopus. Jean Valjean with Cosette and her doll, and others.

HUGO, VICTOR MARIE (1802–1885). This prolific, versatile, and highly gifted writer, who was the greatest literary figure of France in the 19th century, lived in a heated period of his country's history. He was a fiery patriot and so much of his time and talents were given to political controversy. Born at Besançon in eastern France, the son of an officer of the French Revolution, Hugo's childhood was spent in Paris with his mother, in the splendid days of the First Napoleon, and in military camps in foreign countries. His mind and emotions were stimulated by public life, travel, and the atmosphere of glory which invested Napoleon's conquering armies, and the precocious boy wrote a tragic drama at 14. At 17 he took the French Academy prize for a poem, and at 22 was recognized as a master of the lyric and ballad styles of verse. In the full flower of his fame at 30, he headed a literary revolt from the classics, and founded the French romantic school of writers. Most of his followers are forgotten, but Hugo had such original ideas, command of language, splendor of sentiment, persuasion, and sense of melody, that he triumphed over serious faults of hastiness and extravagance. It was predicted that his flame would burn itself out, but poems, plays, essays, historical sketches, and novels followed one another steadily for another half-century.

Hugo was tremendously in earnest as a patriot and social reformer, and a number of his poems, plays, and works of prose fiction are impassioned criticism of the laws and social customs of his time. As a political opponent to Napoleon III, whom he nicknamed "Napoleon the Little," Hugo made himself so dangerous by his eloquence that he was banished from France. During 20 of his most productive years, while living on an island in the English Channel, he enjoyed a world-wide celebrity as "the Exile of Guernsey." There he wrote notable historical papers, rhapsodic memories inspired by personal sorrows, and novels that were translated into many languages. He was 60 years old when he wrote 'Les Misérables' (The Unfortunates), an epic work of fiction. "This," to quote the English poet Swinburne, "is the tragedy of life at its darkest, comedy at its brightest, humanity at its best and worst." Part of the story is summarized below.

Intense in everything, always at the boiling point of fervor, Hugo was often merely violent over the passing event, but he was, in several instances, carried away by passion to the point of inspiration on themes of universal interest. 'Les Misérables' is justly ranked with the greatest novels of all countries; 'Hernani' is thought to be his best drama, and 'Les Châtiments' is a collection of his finest lyrical poems. After the fall of the empire of Napoleon III in 1870, Hugo returned to Paris, where he lived a popular idol for another dozen years. His songs were set to music, his interdicted play 'Le Roi s'amuse' (The King's Diversion) was revived, and he was the chief figure of the French Academy. When he died at the age of 83, the Pantheon—a church in Paris dedicated as the tomb of illustrious men—was opened for the first time in 75 years for his burial. His funeral was one of the most impressive ever held in France.

Victor Hugo's principal works of fiction are: 'Notre-Dame de Paris' (1831); 'Les Misérables' (1862); 'Les Travailleurs de la mer' (Toilers of the Sea), 1864; 'Quatre-vingt-treize' (The Year 'Ninety-three), 1874. Poems and poetic dramas: 'Cromwell' (1827); 'Lucrèce Borgia' (1833); 'Marion Delorme' (1828); 'Les Orientales' (1829); 'Hernani' (1830); 'Le Roi s'amuse' (The King's Diversion), 1832; 'Marie Tudor' (1833); 'Ruy Blas' (1838); 'Les Châtiments' (1853); 'Torquemada' (1882).

The STORY *of* JEAN VALJEAN

FOR breaking into a shop and stealing a loaf of bread to feed his sister's famished children, Jean Valjean was sentenced to the galleys for five years. Several times he attempted to escape and failed; this added to the length of his sentence, until at last when he was released he had served for 19 years. And now that he was free his convict's yellow passport was enough to close all doors against him. No inn would give him lodging for pay and no home would receive him in charity! At last he was directed to the house of the bishop.

"See here!" he said when the door opened in response to his knock. "My name is Jean Valjean. I am a convict, I have been 19 years in the galleys. Since I reached this place I have gone from one inn to another. Everywhere they said, 'Get out!' Nobody would have me. I am tired and hungry."

"Put on another plate," said the bishop, turning to his housekeeper.

"Did you understand me? I am a galley slave—a convict. My passport says I am a very dangerous man. That is enough to have me kicked out wherever I go."

"This is not my house," said the bishop gently, "it is the house of Jesus Christ. It does not ask any comer whether he has a name, but whether he has a sorrow. Whatever is here is yours. What need have I to know your name? Besides, before you told me, I knew it."

"Really? You knew my name?"

"Yes," answered the bishop, "your name is My Brother."

That night after supper, Jean Valjean for the first time in nearly 20 years slept in a bed. Jean Valjean had been a peaceful man, but the unjust cruelties he had suffered had made a criminal of him. And now he arose and took a basket of silverware and fled.

Some hours later Jean Valjean was brought back to the bishop's house by three police guards. Again the good bishop saved him, for to him it was all a great mistake and the silverware was but a gift; and he reproached Jean Valjean for having left the candlesticks behind.

The officers released Jean Valjean.

"My friend," said the bishop, "before you go away, here are your candlesticks; take them." Then drawing near him, he said in a low voice, "Never forget that you have promised me to use this silver to become an honest man. Jean Valjean, my brother," he continued solemnly, "you belong no longer to evil, but to good. It is your soul that I am buying for you. I withdraw it from dark thoughts and from the spirit of perdition, and I give it to God."

But the struggle between good and evil was not yet over for Jean Valjean. Once he robbed a little lad of a small coin. Why he had done it, he could not tell, but when the boy had gone, Jean Valjean suddenly realized with a feeling of horror what a wretch he was. The words of the bishop came back to him, and for the first time in 19 years he burst into tears. From that time forth he was a different man.

One day a stranger, who looked and spoke like a workingman, moved into the town of M— sur M—. In a few years he had not only made himself rich, but had built up the prosperity of the town. Father Madeleine, as the people called him, lived a quiet simple life, doing a multitude of good deeds as quietly as bad ones are usually done. At last, because of the services he had rendered and his high popularity, he was appointed mayor.

Javert, the Human Tiger

One man alone did not share the feeling of veneration which the people had for Father Madeleine, but looked upon him with a suspicious eye. This man was an inspector of police named Javert. He believed that he had seen Father Madeleine before. He continued to watch the mayor stealthily as a tiger, and at last his suspicions were confirmed, for Father Madeleine was indeed none other than Jean Valjean, the ex-convict. And now the clutches of the law again fastened themselves about Jean Valjean and he was sent back to the galleys for life.

Some months later these lines appeared in a Toulon newspaper:

> Yesterday a convict at work on board the *Orion*, on his return from rescuing a sailor, fell into the sea, and was drowned. This man was registered by the number 9430, and his name was Jean Valjean.

Jean Valjean had indeed disappeared in the sea after his heroic rescue of the sailor, but it was not by accident. He had plunged into the sea in order to regain his freedom, for he now had a purpose which he felt he must carry out.

A poor woman named Fantine had been forced to leave her child with strangers in order to obtain work. When she first came to Jean Valjean's notice the poor mother had suffered all the misery that human strength could bear, and she died before her child could be brought to her. As she lay dying Jean Valjean solemnly determined that he would care for the little girl.

He found that the child Cosette, a frail little waif of eight years, had suffered much from curses and blows, cold and hunger. When Jean Valjean placed in the child's arms her first doll and led her away to a new life, her trusting little heart went out to him, and she felt somewhat as if she were near God. And her trust and love helped Jean Valjean to forget the bitterness bred by his early experiences.

Time passed. Still strong and brave in spite of his advancing years, Jean Valjean again and again faced danger and escaped it. But there remained for him one more great struggle. Cosette was now a young woman and Jean Valjean knew that he must give her up, for she loved a young man named Marius. Yet out of his great and unselfish love for Cosette, he risked his own life to save that of Marius. It was at the time of the revolution of 1832. Marius was wounded in the rioting and Jean Valjean carried his almost lifeless form through a terrible route—under the ground through the labyrinth of sewers which underlies Paris.

When Marius recovered, he and Cosette were happily wedded, and though the parting brought sadness to Jean Valjean, he was reunited with them in his last hours, and found joy in their happiness, a reward for his long sufferings.

"Come closer, both of you," he said, when he lay dying. "I love you dearly. Oh! it is good to die so! To you, Cosette, I bequeath the candle-sticks on the mantel. I do not know whether he who gave them to me is satisfied with me in heaven. I have done what I could. My children, do not weep; I am not going very far, I shall see you from there. Love each other dearly always. There is scarcely anything else in the world but that—to love one another."

HUGUENOTS (*hū′gĕ-nŏts*). This name, given in the time of the Reformation to the French Protestants, was probably a corruption of the German word *Eidgenossen*, applied to the Swiss Confederates, with whom the French Protestants had much in common. In their struggles for religious freedom the Huguenots were driven to become a political party, and even a "state within the state," headed by some of the greatest French nobles.

By the middle of the 16th century their numbers and influence had aroused the fears of the Catholic party and the powerful family of Guise. Eight separate religious wars followed, the last of the series ending in 1598. The first war began with an attack by the Duke of Guise and his followers on a congregation of Huguenots assembled for worship in a barn. The peace which concluded the third war was broken by the massacre of St. Bartholomew, the most dreadful of the many crimes that marked this long and distressing era of religious and civil warfare. (*See* Coligny, Gaspard de.)

The Huguenot wars ended in 1598 when Henry IV —himself formerly a Huguenot, but who later conformed to the Catholic church—issued the Edict of Nantes, which gave them political rights, religious freedom, and the possession of certain fortified towns (*see* Henry, Kings of France). Their fortresses were lost with the capture of La Rochelle in 1628 (*see* Richelieu, Cardinal). Although the Edict of Nantes was in other respects confirmed, they were still from time to time harassed and persecuted.

When Louis XIV revoked the Edict of Nantes in 1685 (*see* Louis, Kings of France), all protection of law was withdrawn from the Huguenots. Although they were forbidden to leave France, more than 250,000 of them managed to escape, and carried French arts and manufactures and some of the best qualities of French citizenship to England, Brandenburg, the Netherlands, and the American colonies, especially Massachusetts and South Carolina. France was thereby the poorer, just as had been Spain after the expulsion of the Moors.

LITTLE TALKS ON GREAT THINGS

by Arthur Mee

HUMILITY

WE SHOULD never be ashamed of humility. In this great world, with all the majesty of Nature 'round about him, the proudest man may well be humble.

A man may boast of his knowledge, but it is as a grain of sand on the seashore compared with what he does not know. A man may boast of his possessions, but it is poverty compared with the wealth that belongs to us all. A man may boast of his talents, but he is helpless when Nature comes to him and says, "Thou shalt not do this." The wisest and richest and cleverest of men have need of great humility.

It will help us all our lives to be humble, to be ready to learn, and not to boast overmuch of the powers that came to us from God, not to bear too proudly the precious gifts we were not responsible for. It will help us to sit at the feet of those who can teach us wisdom; it will never help us to pretend to know the things we do not know.

It will help us to remember always the limit of our powers. We may long and dream, we may press on and achieve; and it is right, in one great sense, that we should never be content, though we need not be forever wanting the impossible. We are wise if we do gladly and well the things that come to our hand, knowing that in this world there is need of many kinds of service, and of well-doing in all. "They also serve who only stand and wait."

It is good to have the strength of a giant, but it is not always good to use it so. It is good to know whatever there is to know, but we need not parade our learning as a jeweler shows his diamonds in a window. There is a great story somewhere of a nobleman's son. There was no wiser man in France, and people came from every part of Europe to meet him. A stranger came on a visit to his father's house one day and stayed to luncheon, and at last the time came for him to go. As he was leaving he thanked his host for the pleasant hours he had spent with him. "Yes, yes," said his host. "But, tell me, you really came, did you not, to see our wonderful son?" And the visitor was compelled to tell the truth, and say how much he would have liked to meet him "You sat by him at lunch," said his host. So modest is true wisdom!

It is humility that has given the world its greatest pride. It is the desire to know that has given us all our knowledge. All the glory that is written in books, all the wonder that is painted in pictures, all the immortal music that seems to lift us up to heaven, has come from men who came humbly into the world, went through life in great humility, and were not too proud to learn to serve that they might command, to seek that they might find, to knock that the door might be opened. He is wise who knows, and remembers, that we have come into this world as suppliants, heirs of the wealth that others have bequeathed to us, possessing nothing of our own, but with the mighty privilege of learning to conquer by learning to obey.

There was a great Frenchman named Pasteur. He was to cover his name with the glory that will shine forever in the history of his land, and he wrote to his father at the beginning of his great work praying that he might be able to add one little stone to the temple of human knowledge! He prayed to add one little stone, but in the end he set up a mighty temple in which the human heart will worship as long as the human mind endures.

And, long before Pasteur, there was a great Englishman named Isaac Newton. No man in England knew more than he. A marvelous work he did, astonishing discoveries he made, and all the world is richer because Sir Isaac Newton lived. Yet this great man, one of the greatest men of his time, or of all time, declared that he felt at the end of his life as if he had been picking up a few pebbles on the seashore while the ocean of truth lay unexplored round about him! He had filled the whole world with wonder and set up a kingdom of knowledge, but he felt at the end of it all like a little child picking up pebbles.

So Pasteur begins, so Newton ends, in deep humility, and we do well to be humble, seeing the wonders that they wrought. We need not be ashamed to keep them company; we need not be too proud to pick up pebbles, and so add some little stone as our share of the building up of the glory that awaits us all.

Here is Mother Ruby-Throat and her two babies in a nest in a pitch pine tree.

HUMMING-BIRD. Like a splendid jewel, the tiny humming-bird flashes across a garden at a speed the human vision is unable to follow. Exquisite in form and brilliant in its changeable coloring, this mite is the masterpiece of the whole bird family, though it is usually less than four inches long. Nature never overdoes, so this tiniest of birds does not sing, but squeaks like a mouse.

Humming-birds belong to the New World exclusively. There are about 500 species, nine-tenths of which belong only to the Amazon and Orinoco valleys in South America. All have long slender bills—sometimes longer than the head, neck, and body together—tiny bodies, brilliant plumage, and marvelously developed wing power.

This extraordinary wing power is the result of the humming-bird's feeding habits. Its food is the minute insects which loiter in the depths of flowers too small to support the weight even of so tiny a creature as the humming-bird. So it has developed very strong wings, which sustain it above the blossom, vibrating so rapidly that they make a humming sound and the eye sees them only as a filmy haze. To enable it to reach far into the deep flower-throats it has developed its long beak and its long tapering double-tubed tongue. This tongue can be instantly extended to an extraordinary length to seize insects in flowers or under the bark of trees. The common idea that the humming-bird lives exclusively on the nectar of flowers is a mistake. With the insects it of course gets some of the nectar, but it is the insects, not the nectar, that the bird is after. Like the bees, the humming-birds are very useful in the cross-fertilization of plants, for bits of pollen cling to their bodies and are carried from flower to flower as the little bird searches for food.

The nest of a humming-bird is a tiny cup-shaped affair, such as a fairy might build, and it is made of quite fairy-like material, plant-down, stuccoed with moss and spider-web. The eggs are pure white and never more than two in number.

A FRIENDLY LITTLE HUMMER

The Humming-birds only do this kind of thing for people in whom they have the greatest confidence. If you are very careful and gentle with them and don't try to hurry matters, they'll sit on your finger just like that!

In that part of North America bounded by the Mississippi and the Atlantic, Florida and Labrador, only one species of humming-bird is found. But during the summer months that one, the "ruby-throat," is everywhere present. The male measures a trifle under 3¼ inches from the end of its bill to the tip of its tail, and the female is nearly four inches long. The upper feathers of the male are the glistening green of an emerald, with changeable amethyst lights over the wings and tail; the under-feathers shade from pearl-gray into the darker upper feathers, and the throat is like a glowing ruby, with all its variations of color. The females are more soberly clad. (For illustration in colors *see* Birds.)

Yet for all his splendor, the little fellow is very friendly with his human neighbors and likes to perch about their gardens, calmly preening his feathers, quite unconscious of the delight afforded by the sight of such a performance. Despite its tininess, the humming-bird is a fierce little fighter and will even rout a hawk or crow that ventures too near its nest.

In the ruby-throat and also some other species, the little buglike babies are fed with food the mother bird has partially digested and which she pumps through her bill into the mouth of the fledgling.

Most of the ruby-throats, from as far north as Alaska, winter in southern Mexico or Central America. After migrating to the southern states, these tiny birds some autumn night launch out across the Gulf of Mexico, straight for their winter home 500 miles distant, and, incredible as it may seem, the trip is made without stop for food or rest.

West of the great plains of the United States, a number of other species of humming-birds are found. Among them, California has the Anna's humming-bird, and one of the western species, the rufous humming-bird, is found as far north as Alaska.

Many of the species found in the tropical districts are even smaller and more remarkably clothed than the ruby-throat, for in addition to the brilliant metallic plumage, they have various feather adornments. Of these the most remarkable are the "double-crested," with its growth of amber-like feathers over each eye, and the "tufted-neck," with a wonderful red crest and long green-spotted tufts of red feathers extending from either shoulder.

The humming-bird family is known as the *Trochilidae.* Scientific name of ruby-throat, *Archilochus colubris.*

The Days of CRÉCY, POITIERS, *and* AGINCOURT

A War that Ravaged Europe for More than a Century—What It was All About—The "Black Death" Pestilence that Stalked on Its Heels—How Joan of Arc Drove Out the English

HUNDRED YEARS' WAR (1337–1453). On the side of a little hill near Crécy in northern France, an English army under King Edward III lay drawn up in three orderly divisions late one August day in 1346. On the plain below, outnumbering the English five to one, was a confused disorderly host of mounted French men-at-arms and hired Genoese crossbowmen on foot, under the French king, Philip VI.

THE TRIUMPH OF THE LONGBOW AT CRÉCY

This picture, from an old print, shows clearly one of the deciding features of the Battle of Crécy, in which the French, although outnumbering the English five to one, were so woefully defeated. With their powerful longbows the English archers not only outmatched the crossbowmen of the French but overwhelmed each onslaught of the enemy cavalry before they could come to close quarters.

Suddenly the Genoese advanced to the attack. But they were tired with a long day's march, and their crossbow strings were loosened by the wetting received in a terrific thunder-shower. Although they "shot fiercely with their crossbows," they were no match for the more rapid shooting of the English longbowmen, whose shafts "fell so thick that it seemed snow." When the Genoese saw the arrows falling thick among them they cast down their bows and fled. At this King Philip flew into a rage and cried out, "Slay these rascals, for they will trouble us without reason!" Whereupon his men-at-arms dashed in among the Genoese and slew a great number of them.

"And ever still," says the chronicler Froissart, "the Englishmen shot where they saw the thickest press. The sharp arrows pierced the knights and their horses, and many fell, both horse and man. And when they were down they could not rise again, the press was so thick that one overthrew another."

In one place the French managed to reach a band of dismounted English knights commanded by the Black Prince, the 16-year-old son of Edward III. In haste a messenger was dispatched by the knights asking aid, but when their request was made known to the king, where he watched the battle from the tower of a windmill, he inquired: "Is my son dead, or hurt, or felled to earth?" "No, sire," said the messenger, "but he is overmatched and has need of aid." "Then," replied the king, "return to them that sent you, and say to them that they send no more to me, so long as my son is alive; and also say to them that they suffer him this day to win his spurs, for I will that this day's work be his, and the honor thereof."

As darkness fell the remnants of the French army were fleeing in confusion, but the English lines remained firm in their position on the hill. Thus the English army won at Crécy the first great land battle in the long Hundred Years' War with France.

The war had started in 1337, and it did not finally close until 1453. The causes of the conflict were to be found in the constant clashes growing out of the English holding of Guienne as a fief from the French crown; in the aid given by the French to the Scots in their wars against the English; and finally in the interference of Philip of France and his vassal, the Count of Flanders, with the profitable wool trade of English merchants with the Flemish cities. In addition there was the claim that Edward III himself was rightfully king of France, because his mother was a sister of the late French king, while Philip VI was only a cousin; but the French assembly had decided that the throne of France could neither be inherited by a woman nor by one who claimed through a woman (miscalled the "Salic law").

The conflict was really a series of wars, truces, and peaces, lasting through the reigns of five English kings, from Edward III to Henry V, and of five French kings, from Philip VI to Charles VII. At the time of the battle of Crécy the English had already won command of the English Channel by a spectacular naval victory at Sluys; and after Crécy, the town of Calais, the door into France, surrendered to them on Sept. 28, 1347, after a year's siege.

For almost ten years after that the fighting lagged due in part to a great pestilence, called the "Black Death," which swept over Europe, carrying off more than a third of the population (*see* Black Death).

Not until 1355 was the struggle between the two countries renewed. The English now carried the conflict into southern France, instead of confining it to the northern section as before. At Poitiers (1356) the Black Prince with a small army of Englishmen was confronted by an overwhelming French force. In vain the Prince offered to surrender his spoils and his prisoners and to promise not to fight for seven years if he might be allowed a safe retreat. This offer was rejected, so certain did the French feel of victory.

The Longbows Win the Day at Poitiers

The Black Prince arranged his troops on a little plateau protected at the flanks by a hedge and by rough and marshy ground. The brave but inefficient French King John threw away his advantage of superior numbers by ordering his knights, weighted down with their armor, to dismount and advance on foot against the hail of English arrows. "There was a sore fight that day," says the chronicler, "and many a great stroke given and received." One after another the three divisions of the French army were thrown into confusion. King John and his youngest son, refusing to flee, were taken captive by the English. Again the victory was due to the new English weapon —the "longbow," with its "cloth-yard shaft"—and to the trained skill of the English archers.

The horrors of a peasants' revolt and civil strife were now added to the miseries of France. A treaty with England was finally concluded at Bretigny in 1360, by which King John was to pay a large money ransom, and Edward III was to have Guienne, Crécy, and Calais in full sovereignty. In return Edward III renounced all claim to the French crown.

But in 1369 the new king of France, Charles V, physically weak but intellectually strong, found an excuse for breaking the treaty and renewing the war. Aided by the able Breton general, Bertrand du Guesclin, he organized an army of professional soldiers instead of the medieval knights, and by cautious maneuvering brought one place after another into his hands. Only Calais in the north and Bordeaux in the south remained to the English at the time of Charles' death in 1380.

Victory of the English at Agincourt

For nearly a generation the war then languished, due to factional strife for power in both England and France. Soon after the accession of Henry V, the hero king of England, it began again. At Agincourt, near Crécy, a small English force was again confronted in 1415 by a large French army. The French, it seemed, had learned nothing from the disasters of Crécy and Poitiers, or from the exploits of Charles V and Du Guesclin. As in the two former great battles, their forces consisted chiefly of dismounted knights weighted down with heavy armor. And again they were packed close together, in a narrow newly-plowed field between two woods, in which they sank almost to their knees. Shakespeare makes Henry V say, the night before the battle, that he "wished not for a single man more" to share the glory. A third great English victory, equal to those of Crécy and Poitiers, was the result.

By the Treaty of Troyes (1420) the defeated and disunited French agreed that Henry V should marry Princess Katherine, the daughter of Charles VI of France; that during the life of this insane king, Henry should act as regent; and after Charles' death Henry should reign as king of France as well as England.

Henry V did not live to wear the French crown for he died seven weeks before Charles passed away (1422). The death of these two monarchs left the claim to both thrones to Henry VI, the nine-months-old son of Henry V and Queen Katherine.

The English claims in France, however, were disputed by the disinherited dauphin of France, later Charles VII, who refused to accept the Treaty of Troyes. For a time he was too weak to be feared and at the end of seven years it seemed that Orleans, his last considerable stronghold, would surely fall to the English.

The Wonderful Maid of Orleans

Just at this darkest moment in the fortunes of France, a new force appeared in the person of Joan of Arc, the Maid of Orleans (*see* Joan of Arc). Inspired by her patriotism the French forced the English to raise the siege of Orleans. Victory followed victory in rapid succession, until finally Joan led the dauphin through a hostile country to be crowned at Reims as King Charles VII. Even after Joan's capture and execution by the English and Burgundians her spirit seemed to inspire the French and to wake in them a new national sentiment. Little by little they drove the English back. Finally the war ended in 1453 with only Calais remaining in English hands.

Instead of winning the French throne for the English king, the Hundred Years' War had lost for him the last of those continental possessions which had once been held by Henry II. The French king no longer numbered a powerful rival monarch among his vassals, and soon established an almost absolute power in his kingdom. He enjoyed a permanent revenue and was supported by a standing army equipped with modern artillery—for cannon had come into use either at or since the battle of Crécy. In addition the hundred years' conflict to expel the foreigner from their soil had developed in French bosoms the root of that intense patriotism which today characterizes France. But against these gains for France must be balanced fearful losses inflicted upon its land and people, the check to population, and the brutalization of long-continued warfare.

HOW THE MAIDEN WARRIOR ENTERED ORLEANS

At the head of her devoted soldiers, and holding high her white banner, embroidered with lilies and sacred images, Joan of Arc fought her way through the English army which was besieging Orleans and relieved the despairing French garrison within. We see her troops entering the gate over the drawbridge which was let down by those chains, as soon as the enemy had been driven off. That standard of Joan's was looked upon as an omen of victory. In besieging Tournelles, for example, she fell wounded, but passed her banner to a soldier, saying that when it touched the walls, they would surely enter. And so they did.

The BROAD HUNGARIAN PLAIN *and Its Picturesque People*

This is one of the little bell towers you will see in the villages all over Hungary.

HUNGARY (*hŭn'gȧ-ry*). Within half an hour of its capital city, Budapest, lies the heart of the present republic of Hungary—the great *Alföld* ("lowland plain"), the richest agricultural land of Europe, as level as a threshing-floor and of amazing fertility. Through its fertile expanse flow the broad winding Danube and its sluggish tributary the Theiss, fringed with marshes. Cornfields that stretch uninterrupted as far as the eye can reach give way to vaster fields, where peasants in the garments that Asia wore before the Christian era are feeding countless stacks of wheat to modern threshing-machines.

It is a peaceful land of broad meadows, strips of clover, huge windmills moving surely but leisurely, like the Magyar himself; of vineyards, long stretches of bright red peppers from which paprika is made, and purple alfalfa fields; of huge rectangles planted with tobacco, cabbage, potatoes, or sugar-beets. The landscape is everywhere dotted with splotches of red and blue—the full bulging skirts and 'kerchiefs of the peasant tillers of the plain. Stubble-fields, gorgeous with poppies and sunflowers, contrast vividly with occasional patches of fallow land or pasture, where "Little Boy Blue" is tending a flock of snow-white geese. High well-sweeps are always in sight.

Splendid asphalt roads, shaded by long rows of Lombardy poplars, lead off in every direction—past one village after another of whitewashed walls, red-tiled or straw-thatched roofs, church spires, and often the graceful stony finger of a mosque, to remind one of 150 years of Turkish rule over Hungary (1526–1683). The long narrow peasant houses look out on the street over little gardens of old-fashioned flowers, walled in with whitewashed sun-dried brick.

Farm Life a Fine Art among the Magyars

In his home the "Magyar" (as the true Hungarian calls himself) has reached a high stage of peasant culture. When he can afford a floor of wood he has it, even in the kitchen; when he must put up with an earthen floor, it is compact, hard, and wonderfully clean. In his kitchen, as clean and orderly as his front room, his wife cooks in a pot which hangs from a crane over an open fireplace, or on an earthen or tile stove with a tiled chimney. His passion for china and earthenware, dishes and bowls, and the pitchers and mugs with which he loves to line one or more of the walls of his house, is only exceeded by his love of flowers. He refuses to live without flowers and fruits and trees.

The Magyar's conception of a completely furnished house goes beyond mere furniture in sufficient quantity. His furniture must be decorated, his chairs and benches painted, his great chests carved. The walls are tinted, as are the great beams and boards of the ceiling. He even decorates his veranda, and always the gable ends of the house, with tasteful designs in carving or bright paints. The outside walls of the house are always white and clean. His pigpens, corn cribs, stables, and barns are substantial and often decorated in colors. The yard about the house is clean and orderly, either graveled or covered with compact turf. His fields are not disfigured with either fences or weeds.

Vast estates belonging to the church and nobility until recently occupied a large part of the Alföld; 77 per cent of the peasants owned no land at all. With the change of government after the World War of 1914-18 most of the estates were broken up into small holdings.

The Hungarian Steppes and the Cowboys

Between the Alföld and the vineyard-clad foothills lies the *puzta*, or steppes of Hungary, which resembles the Alföld as it was before the days of agriculture. Treeless save for small clumps of locusts near the widely separated peasant homes, it is the range-land of thousands of big-boned long-horned Hungarian cattle and flocks of sheep, patiently tended by tall fellows in sheepskin greatcoats and cowhide sandals, who lean on their crooks and seem always intent on some far-away world, while they puff lazily at their long pipes. Here, too, are seen many camps of the Tziganes (*tsĭg'ă-nĭz*) or gipsies. About their queer brown tents naked dark-skinned children roll in the grass; and the men, with gaudy spangled waistcoats, flapping trousers, and broad-brimmed hats stroll lazily about or idly pick the many-hued flowers while the gaily bedecked women tend the fat wild turkey or young pig that hangs roasting over the fire.

The Magyar is a little shorter in stature than the average American, strong and healthy. His appreciation of the beautiful, so evident in his architecture, his innate orderliness and cleanliness, his passion for flowers and music, is second only to his love of his land and his absolute independence of spirit and self-confidence. He is generous to a fault and extravagant, but hard-working. He does not like trade, which has fallen almost entirely into the hands of the Jews. The Magyar tongue is closely related to that of the Finns, Lapps, and Ostiaks of Asia, and bears little relation to the other languages of Europe except the Turkish. Although our alphabet is used, no word on a Magyar printed page gives us any hint as to its meaning, since the language has practically no

Latin or Teutonic roots. This makes the very extensive literature written in the Hungarian language a sealed book to most Europeans and Americans.

The Great and Beautiful City of Budapest

Budapest, the seat of government, with a population of nearly a million and a quarter, is beautifully situated on both sides of the Danube (*see* Budapest). Other important cities are Szegedin and Debreczen. A very complete system of state-owned railroads connects the principal cities with one another and with the outside world. The Danube River also affords a great avenue for commerce. Before the World War Hungary had a great export trade in flour, wheat, corn, barley, cattle, beef, pigs, horses, and wine in barrels. Manufactured goods in cottons, woolens, silks, and leather were the principal imports, coming largely from Austria.

The new Hungary (or Magyaria)—extending from the River Drave on the south to the Danube on the north, and from the neighborhood of Pressburg on the west to the mountains inclosing Transylvania—with its 36,500 square miles, is less than one-third the area of the old kingdom as it was under Hapsburg rule.

The Magyars, a Finno-Ugric race, first came as nomadic raiders from Asia, up the valley of the Danube, as early as the 9th century. After their defeat by the Germans at the Lechfeld (in Bavaria) in 955, they settled down as permanent residents—an island of Asia in the heart of the Slavic east of Europe—in the broad valley of the Theiss. In the year 1000 their king, known in history as St. Stephen, accepted Christianity and a crown from the Pope. In the 15th century John Hunyady, the great national hero of Hungary, defended the land as regent against the oncoming floods of Turkish conquest, until his death by plague a few days after his successful relief of Belgrade from Turkish siege (1456). On the fatal field of Mohács (Aug. 29, 1526) the last of the Angevin line of Hungary's kings perished, with 20,000 of his men, and the horsetail standards of Sultan Solyman the Magnificent were soon spread over almost the whole of the land. Over the small remnant of non-Turkish Hungary, the Hapsburg Ferdinand of Austria (brother of Emperor Charles V) was chosen to rule. It was not until 1718 that his successors completed the redemption of Hungary from Turkish rule.

A TYPICAL HUNGARIAN FARM HOUSE

We are looking through the arched openings of the porch of a Magyar house of the better sort. How white and clean the walls look, and how neat the yard! The pigpens, corn cribs, stables, and walls are all of the same substantial build.

Origin of the Dual Monarchy

Restiveness under the sway of the Austrian Hapsburgs led Hungary in the course of the ill-fated Revolution of 1848 to establish a short-lived republic, with Louis Kossuth as president. When this was put down, Austria was obliged (1867) to grant Hungary equal partnership in what was thenceforth known as the "Dual Monarchy" of Austria-Hungary.

The World War resulted in a greatly reduced Hungary, but gave it complete independence. It largely did away also with Hungary's "nationalities problem" by lopping off the Slovak strip along the Carpathians for Czecho-Slovakia, giving Transylvania to Rumania, and Slavonian-Slovene-Croatian territory on the west to Jugo-Slavia. Now the Magyars of the greater and lesser Alfölds, where the population has always been almost wholly Magyar, have a chance to show the world what is in them, and to correct the reputation given them by the noble and official class, as proud and harsh rulers of subject peoples. The monarchical form of government is preserved, though opposition of the powers prevents a return of the Hapsburgs to the throne. Population, about 7,850,000.

HUNS. A writer of the early Middle Ages gives us a picture of this savage wandering race of that time. "Nations whom they could never have defeated in fair fight," he says, "fled in horror from those frightful faces, if indeed I may call them faces; for they were nothing but shapeless black pieces of flesh, with little points instead of eyes. They have no hair on their cheeks or chins. Instead, the skin of their faces shows deep furrowed scars; for hot irons are applied to the face of every boy that is born among them, so that blood is drawn from his cheeks before he is allowed to taste his mother's milk. The men are little in size, but quick and active in their motions, and they are especially skilled in riding. They live largely on half-raw animal flesh, which they merely warm by placing it between their own thighs and the backs of their horses. On horseback every man of that nation lives day and night. On horseback he takes his meat and drink, and when night comes he leans forward on the neck of his horse and there falls asleep." This lively account by a hostile writer might not have been accepted as history had not the Huns so often lived up to the bad reputation he gave them.

In 374 A.D. the Huns crossed the Volga River and entered Europe for the first time from their homes in Central Asia. They conquered the Ostrogoths, and driving the Visigoths across the Danube occupied the region north and west of the Black Sea. There they lived for more than 70 years, before they began their second and greater wave of invasion. In 451, under Attila, the "Scourge of God," they swept into Germany and crossed the Rhine into what is now France, laying waste the country with fire and sword. In a bloody battle near Chalons he was defeated by a combined army of Romans and Visigoths under Aëtius and forced to retreat. The next year the Huns descended into Italy, devastating the country. They would probably have taken Rome, as Alaric had done 40 years before, had it not been for the bravery of Pope Leo I, who in an interview so overawed the fiery Hun that he spared the city and withdrew from Italy. With the death of Attila in 453 the empire of the Huns, which included all the peoples from the Volga to the River Rhine, quickly fell to pieces. The remnants of Attila's following either went back to Asia or mingled with the peoples they had subdued. Their great leader lived on in German legend as Etzel in the 'Nibelungenlied'. The Magyars, who several centuries later settled what is now Hungary, were related to the Huns.

DO YOU WONDER PEOPLE FLED IN HORROR?

"Nations fled in horror from those frightful faces, if indeed I may call them faces; for they were nothing but shapeless black pieces of flesh with little points instead of eyes." Such were the Huns, as the medieval chronicler depicts them, and the hair of those fierce mustaches was all the hair that was allowed to grow on their faces, for, says this quaint old writer, hot irons applied to the faces of the baby boys burned out the hair on cheek and chin before ever they were allowed to taste their mother's milk.

HURON, LAKE. The second largest of the Great Lakes, Huron, is about 250 miles long and its average width is about 150 miles. With Georgian Bay its area is 23,200 square miles. So irregular is its shape that a line drawn from the head of Saginaw Bay to the far shore of Georgian Bay is nearly as long as the lake itself. Its level and its depth are about the same as those of Lake Michigan, with which it connects through the Straits of Mackinac, its surface being 581 feet above and its bottom 121 feet below sea-level. Its greatest depth is 702 feet. In spite of the mountainous billows that the northeasters drive upon its western shore and which make Saginaw Bay the dread of mariners at the end of the season, Lake Huron is a great highway of traffic. Its own ports are of secondary importance, however.

The most beautiful scenery of all the Great Lakes is in Georgian Bay, a great arm of Huron, 120 miles long and 50 miles wide, separated from it to the north and east by the long island of Manitoulin. A trip through the North Channel, between Manitoulin and the rocky bluffs of the Ontario mainland, and on among the "Thirty Thousand Islands" that strew the northern half of the bay is one of the most picturesque water voyages in North America. Georgian Bay is becoming one of the most popular vacation spots of the continent, and hundreds of cottages and hotels have been built on its islands within the last few years.

A ship canal is planned to connect Georgian Bay with the St. Lawrence at Montreal, a distance of 440 miles. It is to start at the northeastern corner of the bay, follow French River to Lake Nipissing, then pass by way of a number of small lakes to the Ottawa River, and so to Montreal.

Through the St. Clair River, Lake St. Clair, and the Detroit River, the waters of Lake Huron flow into Lake Erie. The passage between these lakes has been dredged and deepened and about a mile of canal has been constructed. (*See* Great Lakes.)

HUSS, JOHN (about 1369–1415). "I am prepared to die in the truth of the Gospel which I taught and wrote." Like Wyclif of England a generation before, and like Martin Luther of Germany who was to lead the great Protestant Reformation a century later, John Huss, the Bohemian religious reformer, defied the authority of the Church and was ready to defend his principles to the uttermost. In his case the uttermost was demanded, and for his views he was burned at the stake as a heretic.

Huss was born of humble parents in the little Bohemian village of Husineç. He was christened Jan or John, and from his birthplace was called John of Husineç, or, in shortened form, John Huss. Having decided to become a priest he entered the University of Prague and after his graduation became a lecturer there on philosophy. For a time he was a rector of the university. He also took a prominent part in the nationalist Bohemian protest against the undue influence of Germans in the university, which in 1409 led the German masters and scholars to secede and found the rival University of Leipzig.

As a preacher Huss won the hearts of the people by his powerful sermons in the Czech (Bohemian) tongue, as well as by the purity and nobility of his life. His attacks on evil living among the clergy, although in this he was supported by the archbishop of Prague, won him much enmity.

Huss had early come under the influence of the religious and philosophical writings of John Wyclif, which had gained a strong hold in Bohemia. These were written in Latin, which was then the universal language of scholars, and so were as easily read by one land as another. Huss adopted many of the philosophical and religious teachings of Wyclif; he did not follow him, however, in the rejection of the doctrine of transubstantiation, but held to the orthodox belief. Nevertheless when Huss opposed the burning of Wyclif's books, he was charged with heresy and forbidden to preach or to teach.

JOHN HUSS

"I am prepared to die," he said, "in the truth of the gospel which I taught."

The struggle was complicated by the fact that this was the time of the Great Schism in the Church, when there were three rival claimants to be pope. The climax came when Huss attacked the granting of indulgences in Bohemia by one of the three claimants for aid against his enemies, and the pope's bull was burned by his followers amid much disorder. Huss was now excommunicated, and for two years went into retirement. He used the interval for writing defenses of his views, and incidentally he became one of the founders of the Bohemian tongue as a literary language.

When the Council of Constance met in 1415 to heal the Great Schism and consider the question of reforms in the Church, Huss attended it under a safe-conduct from the Emperor Sigismund to justify his views. On his arrival he was arrested as an excommunicated heretic and thrown into prison. His condemnation was a foregone conclusion. When he steadfastly refused to recant his teachings, unless shown that they were in conflict with the Scriptures, he was condemned to death. As the sentence was passed he gazed steadfastly at Sigismund, who had the grace to blush with shame at the thought of his violated safe-conduct.

Huss met his death (July 6, 1415) with heroic constancy, as also did his disciple Jerome of Prague, a year later. "Thinking to extinguish heresy," says an English historian, "the Council of Constance had made it the national faith of Bohemia, and had made the martyr Huss the national hero and the national saint." The immediate result was the terrible Hussite War, a struggle on the part of the Bohemians for national, religious, and social revolution, in which they resisted the combined force of Europe in numerous "crusades" and for nearly a score of years prevented Sigismund from securing his inheritance of the Bohemian crown.

HUXLEY, THOMAS HENRY (1825–1895). Rugged honesty, blithe courage, and unaffected humanness were the outstanding qualities of this great biologist who for more than 40 years was the foremost British champion of the new scientific doctrine of evolution. Educated as a physician, Huxley on graduation obtained an appointment as surgeon in the British navy. Among the many valuable studies of sea creatures that he made during a voyage to Torres Straits (1846–1847) was one 'On the Anatomy and Affinities of the Family of Medusae', which was to furnish a most important link in the theory of evolution. This was before the publication of Darwin's 'Origin of Species', but Huxley here gave the first hint of the now accepted principle that the growth of a highly developed creature from embryo to adult is a hurried retelling of the story of the evolution of that species.

Darwin said that Huxley was one of the three men in England whom he needed to convince of the theory of evolution in order to satisfy himself. So thorough and earnest a convert did Huxley become that his popular lectures and writings in defense of Darwin's theory have somewhat obscured his own original work in biology and zoölogy.

From 1854 to 1885 he was professor of natural history in the Royal School of Mines, London, being the first great teacher of biology by the laboratory method. Toward the end of his life he gave much time to public work in general education, to improving legislation concerning the fisheries, and the like, for he believed, in his own words, that he was "a man and a citizen before he was a philosopher."

Among Huxley's best-known writings are: 'Evidences as to Man's Place in Nature' (1863); 'Lay Sermons, Essays, and Reviews' (1872); 'The Crayfish: An Introduction to the Study of Zoölogy' (1880); 'Scientific Memoirs' (4 vols., 1898–1902).

HWANG RIVER. Winding through the mountains and over the fertile plains of northern China flows the great and terrible Hwang Ho ("Yellow River"), the "Sorrow of China." In its keeping are the lives and the fortunes of millions of people, and like a capricious giant it deals out death or wealth by turns. For thousands of years, since the earliest dawn of Chinese history, the people have struggled with this giant, trying to curb his strength, and today they are no nearer conquering it than ever.

Through the first two-thirds of its course the river, which is the second in size in China, flows through mountains, falling rapidly. The soil of these mountains is a yellow earth which dissolves easily and is washed down in enormous quantities by the river, staining its waters the deep yellow from which it, and the Yellow Sea, get their names. But as the river leaves the mountains and starts across the flat plains it begins to deposit this sediment. By degrees the bed rises and the people build embankments to prevent the river from overflowing. As the bed rises the embankments must be raised too, until the stream is flowing many feet above the level of the surrounding country. As time goes on the situation becomes more and more dangerous; finally a breach occurs and the whole river pours over the country, carrying destruction and ruin with it. If the breach cannot be repaired the river leaves its old channel entirely, and finds a new exit to the sea along the line of least resistance. Many times it has thus changed its course, entering the sea through different mouths as much as 500 miles apart.

In 1851 the river made such a change, and since then it has flowed to the north instead of to the south of the rocky peninsula of Shantung. It took 15 years to repair the damage, and even then many changes remained. The southern valley from a well-watered fertile plain was left practically without water. The northern valley was also injured because the river deposited three feet of sand and mud over the fields. Later the northern valley gained greatly in fertility because of the new water supply. In 1887 another flood occurred which swept away whole villages, killing more than a million people and flooding 50,000 square miles of territory.

The Hwang Ho rises in the mountains of Tibet, not far from the headwaters of the Yangtse Kiang. It makes first a great sweep to northward, and then, having struck a high mountain range, turns due south for 500 miles. It then turns eastward towards the sea. Although it is the second river in China, it is too shallow in winter, and too swift in summer, to be navigable. Its total length is about 2,700 miles.

HYACINTH. The ancient Greeks told this story of the origin of the beautiful and fragrant hyacinth. One day, said they, the god Apollo was playing a game of quoits with a young mortal, Hyacinthus, whom he dearly loved, when Zephyrus, the god of the west wind, passed by. Being jealous of Apollo the west wind blew the latter's quoit aside, and caused it to strike poor Hyacinthus, inflicting a mortal wound. In a few moments Hyacinthus died in Apollo's arms. In his memory the grieving Apollo then caused these beautiful clustered blossoms to spring from the fallen drops of the youth's blood.

A HYACINTH IN BLOOM

Once an insignificant wild flower, the garden hyacinth has been civilized and turned into a beautiful plant with rich, sweet-scented blossoms.

At all events we know that the wild hyacinth was originally found in Greece and Asia Minor. It was by comparison an insignificant plant. Brought to western Europe in the 16th century, the hyacinth was extensively cultivated by Dutch horticulturists. They succeeded so well that the original blue and purple blossoms were varied to numerous shades of pink, rose, yellow, scarlet, and pure white, so that today we have a splendid selection from which to choose. The best bulbs are still grown in Holland, where gardening is a national industry.

The hyacinth proper belongs to the lily family. The water hyacinth (*Eichornia speciosa*), which occurs in American tropical and sub-tropical regions, is a member of a different family, *Pontederiaceae.* It grows in such profusion and spreads so rapidly that many rivers in the southern part of the United States are choked with the plants and water traffic seriously impeded. Various methods have been tried of eradicating it. Army engineers send out boats to cut out the jam of hyacinths as soon as it forms and the tangled mass is pushed into the current to be carried away. Experiments are being made with a parasite which attacks the leaves from beneath and in time kills them. Although it is almost without food value, cattle seem very fond of it and have been in some instances lured to death in efforts to obtain it.

Scientific name of garden hyacinth, *Hyacinthus orientalis.* Flowers small, bell-shaped tubes with 6 recurved segments; borne in a crowded raceme on a stout scape; stamens 6 in number. Leaves narrow, erect from the base and 8 to 12 inches long. Bulb produces long fibrous roots.

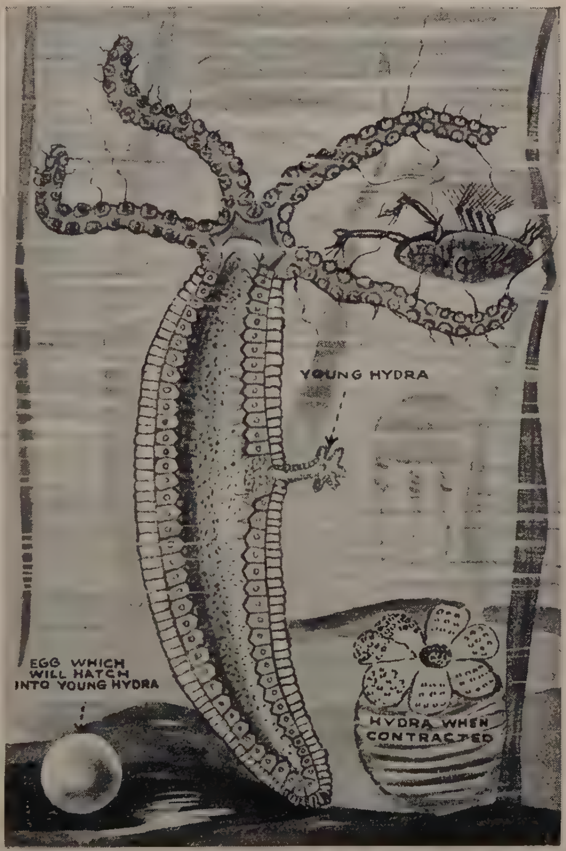
HYDERABAD'. In the center of the peninsula of India, between the provinces of Bombay and Madras, lies Hyderabad, the largest and most important of the states, with an area of 82,698 square miles, and a population of about 14,000,000. Its ruler is the "Nizam," whose wealth and power surpass that of all the other princes of the Indian Empire. In the 17th century Hyderabad was a province of the Mogul Empire whose capital was at Delhi; but with the decline of that power in the 18th century the Nizam became independent. The ruler and the government officials are still Mohammedans, although the people are chiefly Hindus. In the great Indian Mutiny of 1857 the Nizam remained loyal to the British, and his successor was one of the most active Indian princes on the Allies' side in the World War.

Hyderabad is a plateau about 1,200 feet above sea-level. It is rich agriculturally and has great mineral wealth, especially coal. Irrigation, railroads, and manufactures have brought great prosperity to its rulers. The products include millet, rice, wheat, oil-seeds, cotton, tobacco, sugar cane, wild silk (*tussur*), lac, gums, and oils.

But of greater interest to visitors are the relics of India's historic past which abound in this region. Chief among these are the marvelous temples at Ellora and at Ajanta in the northwestern corner of the Nizam's dominions. Most of these consist of caves carved out of the rock and decorated with weirdly beautiful designs and figures made at the cost of enormous labor. The Kailas at Ellora is looked upon as one of the wonders of the world, for not only was its interior hewn out into great chambers and altars and bas-reliefs, but the outside of the rock-bound hill which formed its roof was chipped off bit by bit and fashioned delicately into an exterior of graceful and intricate design. As it stands today, the temple looks as if it had been built up stone by stone, until a closer inspection shows that its walls and colonnades, its obelisks and the thousands of mythological figures grouped about it are all part of one great carved rock.

The city of Hyderabad, capital of the Nizam's state, is the fourth largest city in India (population, about 500,000). In the Sind region of northwestern India is a city likewise called Hyderabad, but it is of lesser importance.

THE HYDRA CAPTURES A MEAL


YOUNG HYDRA
EGG WHICH WILL HATCH INTO YOUNG HYDRA
HYDRA WHEN CONTRACTED

This picture shows a hydra very much enlarged and cut in two from top to bottom so you can see how it is made inside. Two of its tentacles are engaged in capturing a crustacean. Despite its relatively large size, the crustacean cannot even resist, for those tiny threadlike darts which the hydra shoots out bear a paralyzing poison.

HYDRA. Gather in a bottle some of the floating green weeds or submerged plants or stones from a stagnant pond and empty them into a glass bowl filled with clean pond water. You may then find attached to the plants the tiny fresh-water creatures we call "hydra." But you must become a scientist for five minutes, in order to enjoy and appreciate these small, lowly, and inconspicuous but very interesting members of the animal kingdom.

Hydra a monster? Yes, to the many small animals it preys on; and it does resemble the many-headed Hydra monster of Greek mythology (*see* Hercules) for which it was named. Picture it thus: about the size and shape of the pointed half of a common pin; the larger end sticky, to attach it to any objects in the quiet fresh water of ponds and streams where it lives; in the free end the mouth, capable of opening wide, and surrounded by a circle of about six or eight threadlike tentacles. Imagine the pin a tiny chimney made of two layers of bricks on end, these being the two simple layers of cells in the hydra's body-wall. The cavity inside is the stomach, almost its only organ—no sense organs, no skeleton, and no nervous, breathing, blood, or other systems.

You see hydra was about Nature's first experiment in building animals out of different kinds of cells (*see* Cell). But, once discovered, its plan was used for all of the great branch of animals to which the hydra belongs—thousands of kinds of polyps, sea anemones, and jelly-fishes. Some of its relatives, moreover, branched out, as it were, and evolved into the higher animals, with their many organs and systems for various uses.

Hydra forms daughters mostly from buds on its sides; but in the fall it produces eggs, which hatch out the next spring. When a hydra is injured, lost parts are quickly restored or "regenerated," as the scientist says. If cut into a dozen pieces, each piece will soon form a complete hydra. Curious stinging cells armed with poison are located in the tentacles, which paralyze the small animals that swim against them, enabling the hydra to swallow them.

The few species of hydra, mostly world-wide but seldom abundant, are almost the only fresh-water representatives of their great branch of the animal kingdom (the *Coelenterata*). That is one reason why the biologist prizes them so highly. The name hydra comes from the Greek *hydor*, meaning "water." Two of the more common species of hydra are the brownish *Hydra oligactis*, and the green *Hydra viridissima*.

HYDRANGEA. "Won't you walk into my flowers?" says the hydrangea to the pollen-bearing insects, flaunting her showy outer cluster of sterile flowers which have neither stamens nor pistils and serve only to attract her six-footed visitors in the direction of the small bashful fertile flowers inside.

THE BEAUTIFUL HYDRANGEA

Those big gorgeous blossoms conceal the true flowers inside them. They are the show-windows, so to speak, which attract the insect shoppers.

The hydrangea plays a conspicuous part in the flower pageant of our late summer and autumn gardens. It is a large ornamental shrub with a big globular head of flowers, usually pink, but sometimes bluish or white. There are more than 25 kinds of these hardy shrubs, found chiefly in North and South America, China, Japan, and in the mountains of India. Perhaps the kinds we know the best are those grown as showy borders for our gardens, sometimes eight to ten feet high. We are familiar, too, with the dwarf variety grown in pots that we see particularly at Easter. This variety can be grown out of doors, but it must be stored during the winter.

The hydrangea's name comes from the Greek *hydor*, "water," and *angeion*, "pail." It belongs to the *Saxifrage* family. The large oval strongly veined leaves grow in opposite pairs along the stem. Scientific name of common dwarf variety, *Hydrangea hortensia otaska*.

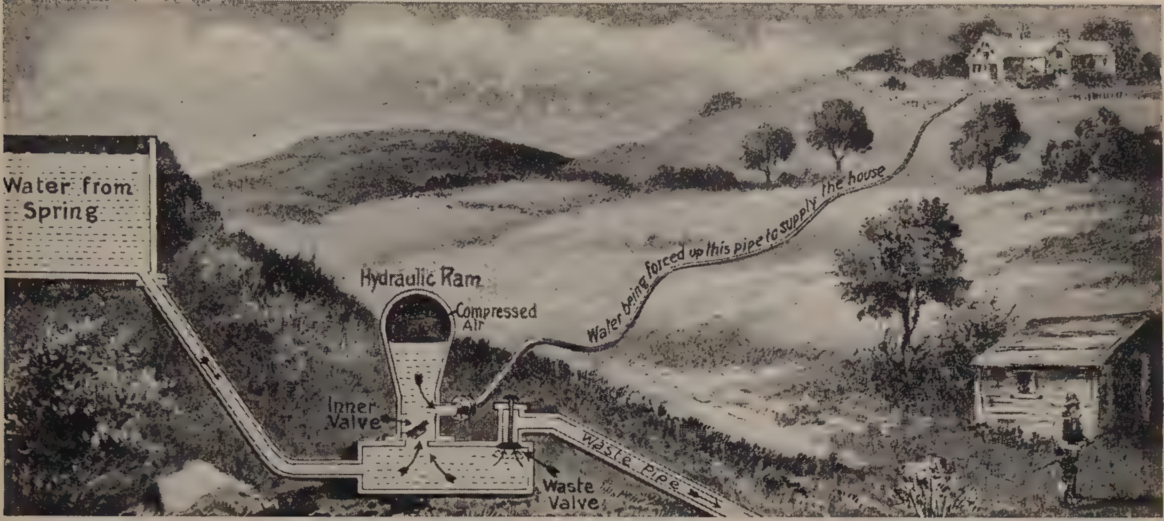
HYDRAULIC MACHINERY. Click-*chug!* Click-*chug!* Click-*chug!* In the green stillness of the wilderness the staccato beat of unseen machinery, quivering the leaves to its rhythm, is a strangely foreign sound. Presently we come upon the source—a little hydraulic ram less than two feet high industriously pumping water to some unseen cottage on the heights above.

Let us see how it works. From a spring basin some 12 feet above the ram, an iron supply pipe brings the water to the ram at our feet. At first the water flows out through a waste valve and is carried off; but presently the increasing force of the water pushing up against the valve closes it, and it clicks shut. The column of water is instantly arrested, just as when we close a faucet. The recoil hurls the water against an inner valve, opens it, and as the water rushes in, the air in the rounded chamber above is compressed. With the recoil of the water the pressure on the waste valve is lessened, the valve drops open, again providing an outlet for the water, which now turns in that direction. The compressed air cushion in the air chamber expands, closing the valve to the supply pipe, and forcing the water through a delivery pipe high to the house on the hill. The waste valve is again closed by the rush of water, and the hammer-like blow comes again at the air-chamber valve. As the process is repeated, over and over, the water is pumped steadily to a height much greater than its source, with no other force than the energy developed by the fall of the water itself. With a plentiful flow of water and a fall of from 1½ to 10 feet, a water supply can be lifted as much as 250 feet by means of the ram mechanism.

The recoil of the water can also be made to drive the sliding piston of a pump attached to the body of the ram, the piston lifting and pumping water through ordinary pump valves. With this arrangement a ram working with muddy water may be used to raise clear spring water.

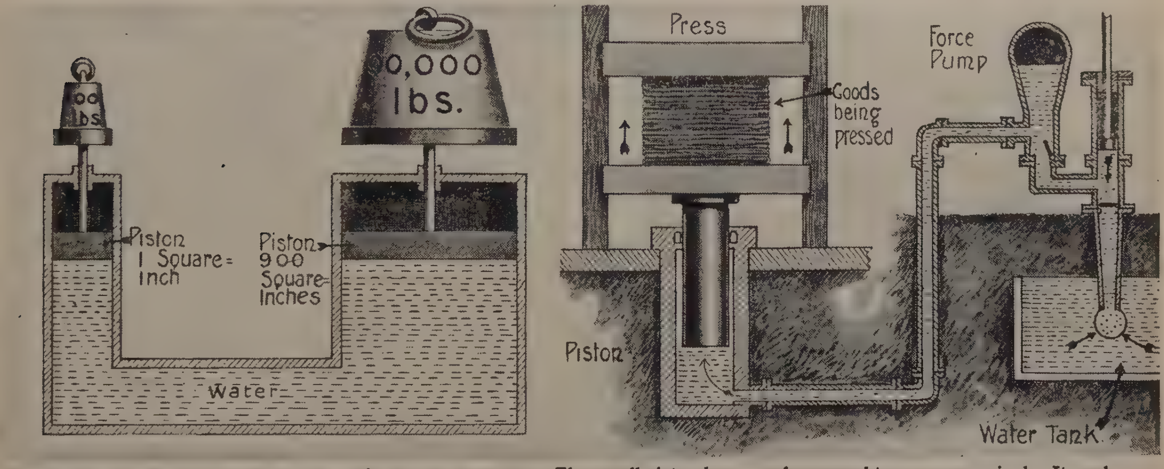
The hydraulic ram is only one of many machines operated with water power. These machines are possible because liquids are, for all practical pur-

HOW WATER PUSHES ITSELF UP HILL



Here you see how a hydraulic ram forces water to "run up hill." From the spring reservoir, the current first passes down through the lower part of the ram and out the waste pipe, until it gains sufficient speed to close the waste valve. This checks its course suddenly, and its momentum carries it up through the inner valve, greatly compressing the air in the air chamber. Once the water loses its momentum, the compressed air forces it back, but this closes the inner valve, and so the water has to go up the supply pipe. At the same time, the rush of pressure being removed, the waste valve opens again, and the whole process repeats itself over and over.

THE POWER OF THE HYDRAULIC PRESS



Here we see how a hydraulic press gets its enormous power. The small piston has a surface equal to one square inch. It pushes on the water, therefore, with a pressure of 100 pounds to the square inch. When this pressure is carried over to the larger piston, with a surface of 900 square inches, you naturally get a total pressure there of 90,000 pounds. The picture at the right shows how this principle is used in an actual press.

Sometimes when firemen are fighting a blaze, a careless truck driver will do a thing like this. The result is, you see, that the flow of the water being stopped while the pressure continues, the hose bursts at its weakest point.

poses, not compressible, and pressure exerted on any part of liquid in a closed vessel will be transmitted equally to all parts of the liquid. This principle was discovered by Pascal, the great French thinker who lived in the 17th century.

One of these machines, the hydraulic press, is so powerful that a man, working an ordinary pump handle, can lift hundreds of tons of weight with it. It seems that this would be possible only with very complicated machinery, but as a matter of fact the hydraulic press is very simply constructed. We have a tank containing two pistons, one much smaller than the other. If the smaller piston is one inch square, and the other 30 inches square, and we exert a pressure on the smaller piston of 100 pounds the larger piston will hold up a weight of 100 pounds to each square inch of its surface—30 x 30 x 100, or 90,000 pounds. If the small piston is a pump that lets in more water with each upstroke, the large piston is slowly but surely raised, exerting its enormous pressure.

Uses of the Hydraulic Press

Before more rapid machinery was invented the hydraulic press was in general use for pressing cotton, paper, or hay into bales, for squeezing oil from cotton seeds, and for punching holes in steel plates. Lead and tin pipes are sometimes made with the hydraulic press. These metals become plastic under tremendous pressure and flow out of the prepared orifices in the same way that macaroni is forced from the machine in which it is made by moderate pressure on the dough.

In hydraulic engines water under pressure pushes back the piston head until a sliding valve is opened by which it flows out. These engines are slow, and have been largely replaced by electric motors, although they are still occasionally used for hydraulic drive elevators or for pumping air for pipe organs. Turbines and water wheels are other forms of powerful machinery operated by water power, and used for many purposes (*see* Turbine).

"Hydraulics" (from the Greek *hydor*, "water" and *aulos*, "pipe") is the name which we give to the science which treats of the flow of water or other liquids in motion. It is partly theoretical, based on the general laws of fluid motions as developed in physics, but largely experimental. It has to do with the flow of water through pipes and canals and over weirs and dams, and with the use of rivers and streams for power purposes. The designing of canals, aqueducts, and pipe lines for drainage and public water-works is an important application of the science of hydraulics.

HYDROCHLORIC ACID. An important colorless compound of hydrogen and chlorine used largely in manufactures, generally under the name of "muriatic acid." A usual method of preparing hydrochloric acid is by treating common salt with strong sulphuric acid. The pure compound is a gas which is markedly different in properties from the solution in water. The gas is non-acidic and conducts electricity poorly, while the solution is markedly acidic and conducts electricity well. The acid unites with most metals and metallic oxides to form salts known as chlorides. (*See* Chlorine.)

HYDROGEN. When a cold flask is heated over a gas flame, beads of water gather on its base as if it were sweating. Is it leaking? No; the flame itself is manufacturing water, for the gas contains the element hydrogen, which forms water (H_2O) when it burns or unites with oxygen. Hence comes its name, which is from the Greek words meaning "water-former."

One of the most interesting of the whole group of chemical elements is this colorless, tasteless, odorless gas, hydrogen. We meet its compounds everywhere —in animal and vegetable tissues and products, particularly the carbohydrates (sugars, starches, fats, and celluloses) and hydrocarbons (natural gas, petroleum, and coal-tar products), and in the universal and indispensable form of water. It is also found in all acids, of which it is the essential and characteristic constituent. Yet it is very seldom found uncombined.

Hydrogen, however, is not active; at ordinary temperatures it is lazy or chemically inert toward most other elements. You can shut free hydrogen up with free oxygen at an ordinary temperature, and at the end of years you will find that they have made no perceptible progress toward becoming water. A spark is needed to effect the marriage. When hydrogen burns it produces a very high temperature. In the oxy-hydrogen blowpipe streams of hydrogen and oxygen in the proportion to form water are forced under pressure from separate containers through a jet, igniting as they issue. The resulting flame produces a temperature of about 5,000° F.

Wherever free hydrogen exists, it tends to escape into the upper atmosphere, for hydrogen is the lightest element known—14½ times lighter than atmospheric air. That is why it is the usual filler for the gas-bags of balloons. Its inflammability, however, is a serious drawback, and aeronauts are glad to welcome another element which, though a little heavier than hydrogen, is non-inflammable (*see* Helium).

Another odd thing about this remarkable gas hydrogen is that its chemical actions in many ways resemble those of metals. The more active metals displace it from water and dilute acids. From some of the compounds of metals with oxygen and chlorine it will in turn displace the metals. For commercial purposes hydrogen is obtained chiefly as a by-product in the manufacture of caustic soda (sodium hydroxide). The hydrogen released by the electrolysis of a solution of salt in water is collected and compressed in steel cylinders. It may also be obtained by liquefying water gas, which is a mixture of hydrogen and carbon monoxide. The hydrogen evaporates more readily than the carbon monoxide and therefore is readily separated.

The chemical symbol of hydrogen is H. Its atomic weight is 1 (or 1.008 according to the more recent international table of atomic weights). It has been liquefied and solidified.

HYDROMETER. With this simple instrument for determining the specific gravity or density of liquids, you can tell whether milk has been watered, the strength of the acid solution in a storage battery, etc. It is a slender sealed glass tube weighted at the lower end so that the instrument will float upright. The level at which it floats in water is marked, and the rest of the tube is scaled like a thermometer. The heavier the fluid in which you place the hydrometer, the higher it floats. So if it sinks less than it should when placed in milk you know that the milk has been watered or that the lighter cream has been removed.

HYENA (*hī-ē′nȧ*). This unpleasant animal, about the size of a large dog, is noted for its cowardice and the unearthly shrieks, like the laughter of a maniac, which it utters when excited. It lives in caves and ruins in central Europe, southern Asia, and Africa, and comes out at night to feed on carrion and start its unearthly howling. The hyena performs a valuable service to the health of the communities which it infests by devouring dead animals and thus acting as a scavenger. So cowardly that it rarely attempts to defend itself, it does not dare to attack an animal that is standing still; but it often so terrifies horses and cattle that they run till they fall from exhaustion. Then the hyena tears its victim to pieces. It was formerly much dreaded in South Africa, where it often entered Kaffir dwellings at night and carried off children sleeping by their mothers.

A HORRID FEAST IN THE DESERT

These are Striped Hyenas, feasting on the carcass of some creature, killed by a lion, perhaps, and left half-eaten for the desert scavengers. Two Jackals have come up, and we can almost hear these four slinking cowardly creatures snarling at one another over the meal. Hyenas love bones, and so powerful are their jaws they can crack even the leg bone of an ox and so get at the marrow.

These carnivorous mammals are related in structure to the cats and the civets. They are ungainly creatures with large heads, and their fore legs are longer than the hind legs, which gives them an awkward, shambling gait. Their powerful teeth and jaws are capable of crushing the hardest bones. There are three varieties of the hyena: the striped, the spotted, and the brown. Probably no other animal has such a reputation for downright meanness and it is therefore a striking fact that even the hyena has the capacity for disinterested affection in his disposition. Herr Schilling, a distinguished German naturalist, who brought two hyenas home with him from Africa, found that they would leave their food—even a beef-bone, which a hyena loves above all things — and trot over to him to be petted! We might also enter on the credit side of the case against the hyena the fact that he was an important contributor to one of the greatest discoveries in the history of science — the theory of evolution. The bones of various prehistoric animals dragged into their caves by the hyenas who once lived in England and France gave material help in establishing the theory.

Scientific name, *Hyaenidae*, distinguished from all other large carnivora except the African hunting dog by having only four toes on each foot, by the length of the fore legs compared with the hind legs, and the non-retractile claws. Chief varieties: *Hyaena striata*, striped hyena, found throughout India, Persia, Asia Minor, and North and East Africa; *Hyaena crocuta*, spotted hyena, South Africa.

WHY EVERYBODY IS DROWSY BUT BABY

In the cozy living room in winter, if you have no ventilation, pretty soon Father will begin to yawn, Brother will doze over his arithmetic, Mother over her fancy work, and Sister will look cross like that! Only Baby will keep lively and cheerful for a while, because the warm used air rises and so he has what little fresh air there is left down by the floor. But by and by, even Baby will begin to fret and cry and Mother will get a headache. Somebody must open a window or they will all be ill.

YOUR HEALTH *and* HOW TO KEEP IT

HYGIENE. You live in a little house all by yourself. It is your body. People who own houses take care of them, and try to live in them just as comfortably as they can. The first thing necessary to live comfortably anywhere is to keep everything sweet and clean and in order.

It is much better to use a house than to let it stand idle. Things rust out quicker than they wear out. So it is with your body. You must use every bit of it, every day, and live in every corner of it. The bones and muscles become weak and stiff if they get no exercise. Working muscles and bone call for more blood. This compels the heart to beat faster and stronger, and the lungs to call for more air to keep the blood purified. All parts of the body should be exercised equally. Swimming, rowing, skating, bicycle riding, dancing, and just plain walking in the fresh air are splendid exercises. Games like baseball, football, basket-ball, and tennis are fine, too. They train both mind and body to think and act quickly (*see* Physical Training). Sweeping a room, hoeing a garden, and splitting kindling for mother are also good for the body. Laziness is rust for body and mind, as well as for the hinges of a door. Don't do anything halfway. Study hard and play hard while you are at it, and then rest.

Health is better than wealth.—*English Proverb.*
He who has health is rich and does not know it.—*Italian Proverb.*
Health and intellect are the two blessings of life.—*Menander.*
Health and good estate of body are above all gold.—*Ecclesiasticus.*
A healthy body is the guest of the soul; a sick, its prison.—*Lord Bacon.*
The first requisite of good generalship is good health.—*Napoleon.*
Strength of body and strength of mind, the reason of the sage and the vigor of an athlete, exhibit the most perfect model of a man and the highest refinement of the mind.—*Rousseau.*
When God would secure to man the highest, best-balanced, most long-continued action of mental and moral power, he does it by giving him a sound physique.—*Mark Hopkins.*
The first requisite of success in life is to be a good animal. In any of the learned professions, a vigorous constitution is equal to at least 50 per cent more brains.—*Mathews.*
No citizen has a right to be an amateur in the matter of physical training. What a disgrace it is for a man to grow old without ever seeing the beauty and strength of which his body is capable!
—*Socrates.*

Next, "don't worry!" You know "care killed a cat," and cats are supposed to have nine lives. Don't hurry, or overwork, or overplay. Don't lie awake and think about "that examination." If you do your best every day, you don't need to worry; and if you *don't* do your best, worrying will only make it worse. If your brain is to do good work it must have sleep. Eight hours for work, eight for eating and playing, and eight for sleep, is a good rule for grown people. Children should have less work, and more play and sleep.

Eat at regular hours. Eat enough at meal times and don't "piece" between meals. It takes several hours to empty a stomach. Don't make a meal of one kind of food because you like it. A dinner all of meat, potatoes, and pie is too heavy for any one but an ostrich. A mixed diet is best for human beings (*see* Food).

Wash your hands before you eat, or else you may get disease germs in your food. Take time to eat. Chew your food. Many grown people eat as if they had to catch trains. This is a greedy unpleasant habit. Besides, it is harmful. In chewing, the mouth makes a liquid (saliva) that the stomach needs for digestion. If you eat too fast, the mouth hasn't time to make enough of it. Besides, your teeth need exercise. The broad grinding teeth in the back of the mouth usually decay first. We use them less than we do the front cutting teeth. Don't overeat. If you fill a furnace too full of coal you smother the fire. Doctors often have to be called to help people digest their Thanksgiving dinners.

When you were rubbing yourself dry, after a bath, did you ever rub little rolls up on your skin? That was dead skin, dust, dried sweat, and oil. Warm water, soap, and scrubbing with a brush remove it. If not removed, it injures your health and makes you unpleasant to other people. To keep the skin clean and healthy, a warm bath with soap and flesh brush should be taken twice a week. Your hair must be shampooed as often as every ten days or two weeks, for dust, oil, perspiration, and dead skin collect on the scalp, too. The hands and face are outside in all weathers, all the time, so you must get into the nooks and corners of ears, nose, knuckles, and finger nails every day. The teeth must be brushed after every meal, and the mouth rinsed. In a warm moist mouth bits of food quickly decay. You cannot keep your food grinders and cutters for 70 years unless you take care of them (*see* Teeth).

THE SIMPLE LIFE!

My! What a happy world this would be if we all followed Little Brother's example, and ate only simple meals at regular hours!

The morning shower or plunge bath in cool water, followed by a brisk rubbing with a coarse towel, brings the blood to the skin and makes you feel warm and bright and active. It makes you feel sudden changes of temperature less, so you do not "take cold" so easily. Don't forget to drink plenty of pure water. Drink four to six glasses a day, and more as you grow older. Water washes through all the waste pipes of the body and cleans them. It is best to drink before breakfast, between meals, and at bed-time. Water at meal times often dilutes the food in the stomach too much for proper digestion (*see* Digestion).

When the lungs are filled with air, they expand two inches or more. That is why your clothing should not be too tight. The lungs go down almost to the waist line. You should breathe deep and full. Clothing should be warm enough for the weather, but not so heavy that it tires you to carry it. The weight should hang from the shoulders, not from the hips. The shoulders were made to carry burdens. Weight on the hips and waist presses down the stomach and all the organs below it. Don't wear shoes in which you cannot wriggle your toes. Shoes for children should have straight broad soles.

Don't be afraid of fresh air. Use it all the time. There is plenty of it and it costs nothing. Your lungs do not like to breathe second-hand air. They need the oxygen that is in fresh air (*see* Air). A great many people are "afraid of night air." That is nonsense. Doctors cure people with sick lungs by having them sleep out of doors. You can keep your lungs well by sleeping with the windows wide open and putting on enough bed clothes to keep warm.

Breathe through the nose, not the mouth. The nose warms and moistens the air and has countless little hairs that catch the dust and keep it from getting into your lungs. If you cannot breathe through your nose, you probably have "adenoids," which are excessive growths of a tissue in the space between the back of the nose and the throat. Adenoids are bad for the health in many ways, and should be cut out by a specialist. Children who have adenoids, in many cases, also have enlarged tonsils, which cause frequent sore throat and other disorders, and therefore should be treated or removed (*see* Respiration).

Fresh air never made anyone "catch cold." But impure air, living in houses that are too warm and close, sitting in drafts, when overheated, and sitting with wet clothing and feet, will often break down the body's resistance and make you catch cold. Keep warm and dry, well-fed, clean, active, and cheerful; drink pure water and breathe fresh air; and you will keep well. Don't go where you know there is anything "catching." People used to think all children had to have measles, mumps, and whooping cough, and that these diseases were not serious. Now we know they are often serious, and that we may escape them if we avoid the germs that cause them (*see* Germ Theory of Disease). Scarlet fever and diphtheria are very dangerous. Don't drink from a public drinking cup, because it is likely to contain the germs of many diseases.

BEFORE EVERY MEAL

It ought to be a natural instinct not to sit down to a nice clean table with dirty hands, and yet many boys do it.

Finally, don't sit "humped up" in a chair or at a school desk. Raise your chest, hold your head up, whether you are sitting, standing, or walking. Wrong habits of posture make narrow chests, round shoulders, and curved spines.

A dentist should examine your teeth twice a year. Even the "baby" teeth should be kept clean and cavities in them should be filled. That will make them last longer, keep the stomach healthier, and make the second teeth stronger and better in every way. That saves money and pain, too.

AND THE TEETH!

Dirty teeth are not only very disagreeable things to look at—and to have—but they are a cause of disease.

If there are singing or buzzing noises in the ears, if the ears ache often or pus runs from them, or you cannot hear what people say to you easily, you should go to an ear specialist. Often ear troubles in children are easily cured, but if you neglect the trouble you may become very deaf. Often children in school are thought to be stupid when they are only hard of hearing (*see* Ear).

Your eyes are the windows of your soul. They should be clear and bright, for you cannot see through dim glass. If print blurs or spots dance before the eyes, if you cannot see without squinting, or know the face of a friend across the street, or if you often have a headache after studying, when you feel well in other ways, you may need to wear glasses. You can injure good eyes in several ways. You must not read very fine print long, or read by a dim light. The light should fall on the page or the work you are doing, not in your eyes; and it should not dazzle. If your eyes feel tired, rest them by bathing them in cold water and closing them awhile.

Good mothers know a great many things to help boys and girls over small troubles. But if the trouble is something she doesn't understand, it is best to see a doctor. Don't take patent medicines. If you are so ill that you need medicine, probably you don't know the kind you need, nor how any kind will affect you. And a great many patent medicines have alcohol and dangerous drugs in them (*see* Drugs; Medicine and Surgery).

So much for the care of your body. But there is another side to hygiene that is just as important, that deals with the household and the community. Unhealthy housing makes unhealthy people.

The house in which you and your family live must be kept clean from cellar to roof. The basement should be light and dry and airy. No decaying vegetables or fruits should be left in it, for these poison the air of the living rooms above. Once a year the walls of the cellar should be whitewashed. The living rooms should be thoroughly cleaned at least twice a year, and the walls calcimined or painted once. If the walls are papered, the paper should be cleaned. Hardwood floors, with small rugs, are the best floor coverings because rugs can be cleaned out of doors and the floors washed. Iron or brass beds are cleaner than wood. Window draperies and all bedding should be washable. Vacuum cleaners or carpet sweepers and soft cloths should be used for sweeping and dusting, because brooms and feather dusters scatter dust. The waste pipes of kitchen sinks, laundry tubs, bathroom plumbing, and ice boxes become foul with decaying matter. They must be flushed every week or so with boiling water and washing soda or chloride of lime, to cut all dirt out. Sunlight and soap are great purifiers, so plumbing should never be boxed in. Old, dirty, boxed-in plumbing is often responsible for sewer gas or foul air about the house. The plumbing, the basement, the gas fixtures, the water supply, and the heating plant are the really important things in a house. A leak in a roof is a slight matter beside a leak in the gaspipe.

FRESH AIR IS SO CHEAP

Some people, when they go to bed, shut their windows to keep out the night air. That's one of the best ways of catching cold.

THE GOSPEL OF THE PUMP

Whether you get your water from the family pump or the city main, be sure to drink plenty of it. It's the best "medicine" in the world!

Stale food should not be allowed to remain in pantries and ice boxes. Garbage should be destroyed every day or carried away. There should not be a crumb of bread or sugar left lying about to coax flies in. Flies bring the germs of typhoid fever and other diseases, so doors and windows should be screened. Food should be fresh. Flour and many dry foods may be kept for months in dry storerooms. If unfit for use they smell moldy. Meat, butter, eggs, and milk also warn us of decay through our noses. Fruit that cannot be eaten while it is fresh should be preserved by cooking.

THAT'S THE WAY TO SIT!

When reading you should sit up nice and straight, like this. So many children get all humped up when they are reading.

A family should be sure the drinking water is pure. Uncontaminated spring water is the best and purest of all. In cities, water is supplied to all the people from reservoirs fed by springs or rivers, or from a lake. Sometimes it is necessary to filter or boil the water. Boiled water should be cooled and air should be put back into it by pouring it from one vessel to another several times. This must be done because boiled water tastes "flat." It is not unhealthful, but people care so little for it that they will not drink enough. Water in city reservoirs is often purified with chloride of lime or other harmless chemicals (*see* Waterworks).

Heat is the next important thing. You do not want a hot-house. Hot-houses are useful for growing delicate plants. Hot dwelling houses grow delicate people. The temperature of a house should be 68 or 70 degrees by a thermometer hung in the middle of the room. And it should be an even temperature, not 85 for a little while and then 60. So the "fireman" of the family should study the heating plant. The house may be heated by stoves, or by a hot-air, steam, or hot-water furnace. Different stoves and furnaces take different kinds of fuel, and different ways of managing them to get the best work from them at the least cost. Sometimes badly managed furnaces give off a poisonous gas (carbon monoxide) that makes people ill. If the furnace is in order and the drafts are used properly, coal gases will go up the chimney.

Once in awhile you read about people being killed while asleep, with gas that escaped from a stove, a furnace, or a gas jet. This could not happen to people who sleep with the windows open, for the gas would pass out of doors, but enough might collect even in a well-ventilated house to make sleepers ill. No coal gas should escape from a furnace or stove, and gas pipes and burner keys should be tested often. Don't look for a leak in a gas pipe or gas stove with a match. Your nose is safer and just as reliable. You can always smell escaping gas. If you can't find the leak that way, send for a plumber. The leak may be from a pipe in a wall, or under a floor. A neglected leakage of gas may not only cause sickness, but also an explosion and fire.

Ventilation should be studied. Fireplaces are the best ventilators, even when there is no fire in them, for bad air is drawn up the chimney. A window lowered from the top a few inches in cold weather lets fresh air in between the sashes and the bad air out above.

What Makes Father Yawn So?

The time we need to be most careful about ventilation is in the winter. On cold winter evenings all the family likes to sit in the cosy living room. If the ventilation is poor, in an hour or two the oxygen supply in the room gets too low for comfort, and the carbon dioxide too high.

Look for these danger signals: Father begins to yawn. The lights do not burn so bright. Big brother feels dull and can't do his arithmetic. Sweet-tempered sister gets cross. The only bright and happy person in the room is the baby on the floor. The baby has the best air of all because warm used air goes up. But even the baby cries after awhile; the canary bird nearly tumbles off its perch and mother has a headache. The bad air almost fills the room. No one knows what is the matter. It's lucky if someone comes in from outside and says: "My, but it's stuffy in here." A window is opened and everyone brightens.

The next time that happens in your family, test the air in the room. Bring in a small glass jar of water and a bottle of lime water. Pour the water out of the jar and let it stand a few minutes to fill with the air in the room. Then pour a half-inch of lime water in the jar and shake it hard to mix the air and water. If there is too much carbon dioxide in the room the water will turn chalky. The remedy is fresh air. Air as bad as that ought to be turned out of doors. (*See* Heating and Ventilation.)

A house should be orderly, quiet, and cheerful. Loud noises really hurt many people. Nerves need rest as well as bones and muscles, brains, and stomachs. In cities, street-cars and railroad trains, factory whistles and wagons and noisy crowds are always hammering at people's nerves. Homes are the places to rest nerves. So don't slam doors or scrape your chair legs on the floor, or throw your shoes across the room, or shout to someone upstairs. You may yell on a farm, or at a baseball game where everyone is yelling. Very good people often quarrel and cry about little things, because their nerves are tormented all the time. Watch these danger signals. Sick nerves take a long time to cure.

Finally, don't take all your troubles into the house to talk over. Long ago a great poet said: "A merry heart goes all the day, a sad tires in a mile-a." This is just as true as that two times two are four. Laugh and grow fat, and save doctor bills. Bring all the cheerful things, the pleasant things, the funny things you come across, into the house. No family is as healthy as it might be unless it is happy.

What Hygiene Is and What It Does

Hygiene deals with the causes and prevention of disease in their relation to the preservation of health. In this sense hygiene has well been named preventive medicine, since it seeks to anticipate the work of the physician by its endeavor to remove the causes on which the diseases that affect mankind depend.

The advance of medical science—especially the progress which has been made in microscopic research into the causes of disease—together with the spread of education, has tended powerfully to awaken national endeavor in matters both of personal and public hygiene. Boards of health are maintained by both states and cities in the United States to enforce measures for the protection of the public health (*see* Health Department). One of the most important phases of their work is represented by the law which in many towns makes compulsory the notification to the authorities of every case of contagious disease which falls under the notice of the householder or medical attendant or both. The authorities, being early informed of the appearance of any cases of these diseases, can take prompt measures for their isolation and their removal, if need be, to the hospital. The seaports, too, are now narrowly watched by the health officers of these ports, and suspicious cases of illness on vessels arriving in harbor are at once dealt with.

Safeguards in the Home

Within the sphere of the home, health science has of late years made satisfactory progress. The principle of safe and sanitary drainage, whereby a house can be trapped off efficiently from the public sewers and the inroads of sewer gas prevented, is beginning to be practiced everywhere. Questions of ventilation and of lighting are being studied, and the warming of houses is no longer left to chance. Personal health, which ranges in its extent from questions of foods and drinks to those of cleanliness and clothes, is not neglected amid the general improvement in hygienic education. Happily, the people at large are beginning at length to perceive and to act on the great truth that only by their personal education in hygiene, and by their knowledge and observance of health laws, can they secure the length of days which of old it was declared Wisdom bore in her right hand.

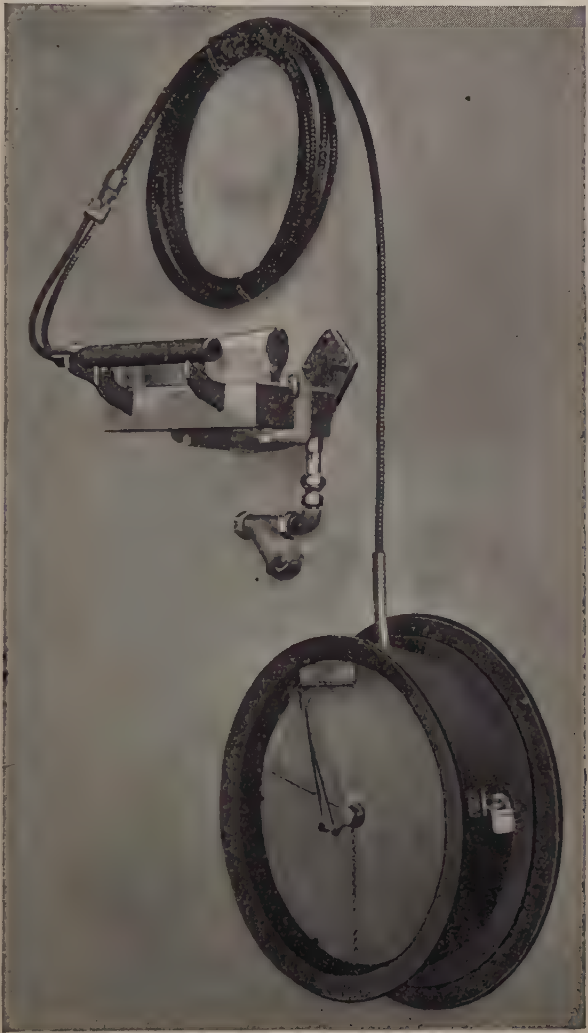
HYGROMETER. One of the important factors which the Weather Bureau must take into account in making its forecasts is the humidity — the amount of moisture in the atmosphere. To measure this, various instruments are used, called "hygrometers." One of the simplest is the toy known as the "weather house," at the door of which a man appears if the weather is about to be wet, and a woman if it is to be fine. It is operated by catgut threads, which grow shorter as the humidity increases and lengthen as it decreases, thus moving the figures. Hair also contracts when moist, and is used in the hair hygrometer, moving a needle on a scale as it changes in length.

The wet and dry bulb hygrometer, also called the "psychrometer," is the most generally used. In the "sling psychrometer" type two thermometers are fastened side by side on a stand, exactly alike except that the bulb of one is covered with wet muslin. The thermometers are then whirled or fanned and the evaporation of the moisture in the muslin causes a fall in temperature in the wet-bulb thermometer — rapid if the day is dry, and slight if it is damp. The dry thermometer records the actual temperature of the air, and by comparing the two readings the humidity can be determined from a set of prepared tables.

Another type is the dew-point or condensing hygrometer. This makes use of ether, which evaporates very quickly and soon cools one of the thermometers down to the point at which the moisture in the air begins to condense as dew. From the dew-point and the temperature of the air as given by the other thermometer, the relative humidity can be determined. In chemical hygrometers the moisture in a given volume of air is absorbed by some such substance as calcium chloride or sulphuric acid, and the increase in weight gives the amount of moisture.

Hygrometers are used in many modern schools and office buildings to measure humidity so that moisture can be thrown into the air when the air becomes too dry (*see* Heating and Ventilation). They are also used in industries in which humidity is a factor, such as the manufacture of textiles, cigars, and paper.

MEASURING AIR MOISTURE



In this type of hygrometer, the "bulbs" are closed tubes filled with a volatile liquid and mounted on a frame with the dry bulb in front, just beneath the coiled tubing at the top. A cloth covers the wet bulb and is kept uniformly moist by the water in the tank into which it dips. The tubing connects the bulbs with hollow metal coils in the circular metal case, and when changes in temperature cause the vapor in the tubes to change in volume, these coils expand or contract. This movement shifts the needles over the face of the card, which is kept slowly turning by clockwork. The combined movements trace a temperature record for each bulb. By referring the differences in temperature to special tables, the humidity at any time can be determined.

HYPNOTISM. Many strange occurrences which were once looked on as miracle, magic, or delusion have been explained by modern science as results of that little-understood mental condition known as "hypnosis" or hypnotism. This condition resembles normal sleep, except that the hypnotized subject may retain some of his active faculties such as the power to walk, talk, and understand what is said to him. At the command of the operator the patient will lose all sensation in a leg or an arm, so that a pin can be thrust in without pain. The heart-beat can be made slower or faster, a rise in temperature and perspiration can be induced, and there are records of cases where drops of blood were made to ooze through the skin. The hypnotized person will perform ridiculous actions, and carry out feats of skill and strength impossible to him under normal conditions. He will "see" people who are not there and if told that a person, who may actually be directly in front of him, has departed, he will believe it, and may even try to walk over the spot where that person is standing.

In light hypnosis a person may remember the facts of his normal life and may recall when he "wakes up" what he said and did while hypnotized; but deep hypnosis produces a complete loss of memory in both respects, unless the operator orders the patient to remember something. Perhaps the most useful feature of hypnotism is found in what are called "post-hypnotic suggestions." These are suggestions made to the patient while hypnotized, which he will carry out afterward. For instance, if the operator tells him that, when he awakens, he must take off his coat as soon as someone coughs four times, the patient will do so, without being conscious of the reason for the action. It is this effect of hypnotism which is used by certain medical specialists in breaking drug habits and other forms of nervous diseases.

How the Hypnotist Controls His Subject

To understand even the simplest facts of hypnotism, it is necessary to realize the close connection between the mind and the body through the nervous system, which centers in the brain. In sleep the faculties of the conscious brain become dulled and lose connection with the body and with each other. But it is possible to keep one or more of the faculties half awake, as in the case of the fireman who sleeps through any amount of ordinary noise but springs up at the faintest tinkle of the fire alarm. A similar condition is produced in hypnosis. All the conscious faculties are put to sleep, except the faculty to respond to suggestions of the hypnotist. The hypnotist's mind and will take the place of the patient's mind and will, and since most of the ideas which might lead the patient to refuse a suggestion are asleep, the body, which remains active, will answer to his commands. The nerve system, which controls the body and carries sensations to the brain, also remains sleeping until it is called into action, and then it may act most powerfully because it is free from the ordinary burden of the thousands of ideas and sensations which make up our waking life. Thus the nerves of the heart and other organs, which work automatically and cannot ordinarily be controlled, become open to suggestion.

The methods used to produce hypnosis are usually simple. The patient is asked to fix his eyes on some nearby object and to make his mind a "blank" as far as possible. The hypnotist says a few low soothing words and may even stroke the head or pass his hands before the eyes. A condition resembling natural sleep sets in, except that the operator keeps the patient's attention and prevents complete slumber. Contrary to popular belief, it is almost impossible to hypnotize a normal person against his will, or cause him to do acts which are contrary to his deep-seated principles.

Some forms of hypnotism have been practiced for centuries. Many of the wonders performed by so-called "magicians" and religious fanatics were doubtless due to the exercise of hypnotic influence. Self-hypnosis is probably responsible for the ease with which Hindu fakirs bear excruciating pain.

When hypnotism first began to be studied, it was called "animal magnetism" or "mesmerism," after Dr. F. A. Mesmer of Vienna, who used it to heal certain nervous ailments in the late 18th century. It remained a great mystery, however, and was generally associated with superstition and fraud, until modern psychology gave it a firm basis in science.

Hypnotism and Telepathy

There are many points of resemblance between hypnotism and telepathy, which is the power to transmit ideas direct from one person to another, even at a great distance, without using the ordinary channels of sense. The fact of telepathy is well established, but theories on the subject are still very vague. Cases in which a person receives vivid pictures of some mishap to a friend or relative, who may be hundreds of miles away, are common. Hypnotic effects have been produced by telepathy when patient and operator were in separate rooms. The powers of clairvoyants, who claim to be able to read the mind and to see things not visible to the normal senses, are supposed to be based, when they are genuine, upon some form of telepathy. But the majority of mind-readers, like most fortune tellers, depend upon fraud in their performances.

The general warning of scientists in all of these puzzling subjects is to avoid taking them too seriously. The practice of hypnotism, while it is usually harmless, may result in upsetting the mental condition of nervous patients, and it should only be employed by expert operators for some beneficial purpose.

I

IBAÑEZ (*ē-bä'nyȧth*), VICENTE BLASCO (born 1867). Spain was kept neutral by German intrigue throughout the World War of 1914–18, but from that land came the novel which contained the most bitter and scathing indictment of German war policy, and some of the most realistic pictures of battle scenes and war devastation. Translated into English it became one of the "best sellers" of the United States. Its title, 'The Four Horsemen of the Apocalypse', refers to the four riders of the Book of Revelations to whom in the dread day of the opening of the seals was given power "over the fourth part of the earth, to kill with sword, and with hunger, and with death." Its chief characters are a wealthy family of Spanish-Americans from Argentina who came to Europe and are drawn into all the horrors of war as the German armies sweep ruthlessly over northern France.

Blasco Ibañez, the author of this work, is one of the most popular writers of Spain today. His father, a merchant of Valencia, Spain, sent him to study law at the University of Valencia. But the young man's disposition proved too restless and vigorous for the practice of law. He took to journalism and became so revolutionary in his views that he served a term in prison before he was 18. But Blasco Ibañez remained constant to the cause of freedom and progress and became one of the leaders of Spain's republican party.

Next to 'The Four Horsemen of the Apocalypse' (1916), his most widely read work is probably 'Mare Nostrum' (Our Sea) published in 1918. This tells the story of how a Spanish captain is lured by the wiles of German intrigue into carrying fuel to a German submarine. By a strange stroke of fate, the captain's son is drowned by that very submarine. Henceforth the broken-hearted father devotes his life to warring against the German pirate-craft. The novel's chief interest, however, lies in its superb descriptions of the Mediterranean Sea (*mare nostrum*), and its wonders of marine life. The earlier novels are chiefly protests against social abuses in Spain.

Among the other works of Blasco Ibañez are 'La Barraca' (The Cabin), 1899, a story of the miseries of peasant life; 'Sangre y arena' (Blood and Sand), 1908, a powerful attack on the sport of bull-fighting; and 'La Catedral' (The Shadow of the Cathedral), 1903, a study of the great cathedral of Toledo and its effect on those who spend their lives in its shadow.

WHAT A SPLENDID PAIR OF HORNS!

This is an Ibex on a high rock of the Himalayas. We may know that this is not an Alpine goat, for look what a long beard he has! The beard of an Alpine ibex is so short you can hardly notice it. The horns of the Asiatic ibex are much longer, too.

IBEX (*ī'bĕks*). The home of the wild goat called the ibex is among the most precipitous and inaccessible heights of the Alps, Pyrenees, Caucasus, and Himalaya mountains. It lives habitually above the line of perpetual snow, only descending to graze at night.

The splendid horns of the male, 30 to 60 inches long, rise from the crest of the skull in a long graceful backward sweep, and are marked on the front with bold cross ridges. The fore legs are shorter than the hind legs, making it easier for the animal to go up a slope than down. The hair is reddish-gray, growing longer in winter.

Ibexes feed in small herds, but the older males usually live alone and at higher levels than the females and the young. The Alpine ibex is now rare and is protected by law. In Asia hunting the ibex is a favorite sport.

Scientific name of the Alpine ibex or steinbok, *Capra ibex;* of the Nubian or Arabian ibex, *Capra sinaitica;* and of the Himalayan ibex, *Capra sibirica.*

IBSEN, HENRIK (1828–1906). Had the circumstances of this noted Norwegian poet and dramatist been easy, and had he success earlier in life, his work would probably have been of a different character; for until he was nearly 40 years old and disappointed by failure and neglect his interest was chiefly in Norse history and legend. Born at Skien, southern Norway, he was because of poverty apprenticed to an apothecary at Grimstad when still a boy, and suffered seven years of drudgery at distasteful tasks. At the age of 19, when he began to write poetry, he appeared to his unsympathetic townsmen as "a gloomy and sinister youth." Unhappiness so spurred him to effort that at 22 he had prepared himself for entrance to the University of Christiania, and had written a tragedy in blank verse. Unable to remain in college long enough to be graduated, he did poorly paid newspaper work, managed a small theater, studied scenic art in journeys to Denmark and Germany, and wrote lyrics and unsuccessful plays for a dozen years.

Finally He Wins Success

The most original of modern dramatists, Ibsen was long in discovering his true bent, and he waited still longer for recognition to lift him above want. His 'Warriors of Helgeland', which marked an epoch in Norwegian literature, and 'Love's Comedy', the first of the social satires for which he is particularly famous, were coldly received at first. In bitterness of spirit, Ibsen left Norway. Two years later, in 1866, he flung back from Rome his splendid poetic drama, 'Brand', and aroused his native country to tardy acknowledgment of his genius. The Norwegian parliament granted him a pension and asked him to come home, but until 1892 he chose to live abroad.

Success won, he devoted himself to writing satiric comedies of modern social life. Setting himself seriously at work to diagnose the ills of society, he abandoned verse and wrote crisp dialogue in everyday language. Misfortune had developed in him a biting irony; and his plays were so audacious, pessimistic, and scornful of social hypocrisy, that they could not be ignored. He challenged heated discussion and was denounced as "immoral." Ibsen's only reply was sarcasm and defiance. His own opinion he put in the mouth of one of his characters: "A minority may be right, a majority is always wrong."

Fame Spreads to Foreign Lands

His recognition was greater abroad than in his native land and amounted to an Ibsen cult in England and America. By some he was held to pose as a moral teacher, like Tolstoy, but this Ibsen himself denied. He was simply a commentator, prescribing no remedies for social evils; and in time it was recognized that his chief claim to distinction was as a playwright. He scorned the "happy ending," and restored to the sentimentalized drama something of Greek simplicity and logic. His plots are masterly, his dramatic sense unerring, his dialogue lifelike. His plays have been translated into all European languages, and presented by gifted actors of many lands; and it is not too much to say that he revolutionized the drama of Europe and America (*see* Drama). He continued to write with vigor until a few years before his death, which occurred at Christiania, Norway, at the age of 78.

To English readers and playgoers Ibsen's best-known works are 'Brand' (1866); 'Peer Gynt' (1867); 'The Pillars of Society'(1877); 'A Doll's House, or Nora' (1879); 'Ghosts' (1881); 'Hedda Gabler' (1890); and 'Little Eyolf' (1894). But in his complete works a total of more than two dozen dramas and dramatic poems are listed.

ICE. When water is sufficiently cooled it becomes filled with a multitude of six-sided needle-like crystals, which increase and interlace until the whole mass becomes solid ice. In water which freezes naturally this change to a solid state begins at the surface and spreads gradually inward. When the freezing process is complete the crystals are so closely packed that they cannot be separately discerned. Fresh water normally freezes at 32° Fahrenheit and 0° Centigrade at atmospheric pressure, salt water at a lower temperature. But if oil is poured over water in a vessel, and the vessel is kept absolutely still, the water may be cooled to 10° Fahrenheit without freezing. If the vessel is slightly shaken or jarred, however, the water solidifies at once. Water expands upon freezing by one-eleventh of its own bulk.

Natural ice is still harvested in large quantities in winter on lakes and rivers, and stored for commercial use. Artificial ice, however, is now more frequently used, as it can be produced on a large scale at all seasons of the year where wanted and so save transportation. (*See* Freezing; Refrigeration.)

ICE AGE. Many thousands of years ago, when the mammoth and the mastodon still roamed the trackless forests of North America, vast ice sheets formed over the northern part of this continent, and over much of northwestern Europe. The ice was so deep that only the highest mountain peaks were visible above it. The ice sheets were formed from snow, which must have fallen in great quantities when the climate was not warm enough to melt it.

In North America the ice reached great thickness; (1) in Labrador, (2) near the western shore of Hudson Bay, and (3) in the mountains of British Columbia. From these areas, the ice seems to have moved out slowly in all directions, but especially southward. The White Mountains of New England were covered, the ice at this point being 4,000 or 5,000 feet thick at least. In southern Connecticut it was something like 1,000 feet thick. The southern border of the ice sheet crossed Long Island, northern New Jersey, Pennsylvania, southern Ohio, Indiana, and Illinois. West of the Mississippi its southern border was not distant from the Missouri River, as far west as Montana. In Europe the ice was at least 6,000 feet deep in Norway. Scotland, Ireland, and all but the southern part of England were covered by ice which was continuous across the North Sea with the Scandinavian ice cap. Much of Germany and Russia were buried beneath great thicknesses of ice.

The glacial period, or ice age, consisted of several glacial epochs, separated by interglacial epochs of milder climate, during which the ice sheets were reduced, or perhaps disappeared altogether. The last glacial epoch ended some 25,000 years ago, as nearly as is now known. The first glacial epoch of the period was perhaps 40 or 50 times as long ago. The melting of the ice produced great quantities of water, which gathered into lakes wherever basins were present. The lost Lake Agassiz, which once covered 110,000 square miles in Minnesota, North Dakota, and Manitoba, was thus formed. It was 700 miles long from north to south. The Great Lakes, after the ice melted back north of their borders, were all larger than now.

The melting of the last ice sheet left a thick deposit of débris, called "drift," on the surface which it had covered. The drift consisted of rocky and earthy débris which the ice had scraped and broken off from the land over which it passed. The irregular distribution of the drift, as well as the erosion of the ice, left many depressions without outlets in the surface, and in these depressions ponds and lakes were formed. Thus arose most of the lakes, ponds, and marshes of the great area of about 4,000,000 square miles covered by the ice sheets of North America.

Scattering Rocks Broadcast

Indeed, the ice sheets made great changes in the physical features of the regions it covered. In addition to the lakes, they left the surface strewn with bowlders of various kinds of rock, some of them of great size. Some of them had been transported hundreds of miles from the places where the ice broke them from the bedrock. Some of the lakes, like the "Finger Lakes" of New York, occupy basins made by the damming of river valleys by drift which the ice left. The many waterfalls within the area covered by the ice, both in the east and west, are in most cases due to changes of drainage caused by the great glacier; for many of the earlier valleys were filled by the deposits made by the ice, and when it melted, the surface waters sought new courses. In the glaciated area there are many peatbeds, formed in marshes which developed in shallow basins in the surface after the ice sheet melted.

The ice, which encroached gradually on regions previously warm, must have submitted all living things to new and disturbing conditions. In consequence some animals became extinct at this time, others moved southward. Thus the musk ox, which now lives in the Arctic region, was driven south before the ice to West Virginia and Kentucky. Man existed in Europe during the early interglacial epochs, but there is yet no evidence that he existed in America until after the close of the last epoch. (*See* Cave Dwellers; Man.)

The cause of the development of these prodigious ice sheets is not known with certainty. Some scientists have believed that it was due to the temporary elevation of those parts of the earth where the ice gathered; but this view does not find much support in fact. Others have attributed the ice age to astronomical causes. This explanation also seems untenable, in the light of known facts. At present, the most probable hypothesis is that great changes in climate are the result of changes in the constitution of the atmosphere. If, for example, the amount of carbon dioxide in the air were to be increased, the temperature of the earth would rise; if decreased, the temperature would become colder. Rational explanations of variations in the amount of carbon dioxide can be suggested. (*See* Geology; Glacier.)

ICEBERGS. Shortly before midnight on April 14, 1912, in the waters of the Atlantic about 1,600 miles northeast of New York, there occurred one of the greatest marine disasters in all history. The giant steamship *Titanic*—the largest vessel then afloat—was making her maiden trip from Liverpool to New York, when she suddenly struck the under-water shelf of an iceberg. Two hours later the ship sank, sucking down all but 706 of her 2,300 passengers, with a property loss of $15,000,000. In answer to frantic wireless calls the *Carpathia* at last reached the spot and picked up survivors from rafts and life-boats. But the iceberg had done its deadly work.

Icebergs are at once the dread of sailors and the wonder of all who look upon them. They are the broken-off ends of glaciers that descend to the sea. They vary in size from tiny cakelike "growlers" to great masses a mile or more in diameter. Although some icebergs are as much as 200 feet above the water, we must remember that "their green roots sleep in the awful deep—two hundred fathoms low." That is, only an eighth or a ninth of the weight of the ice is above the surface of the ocean.

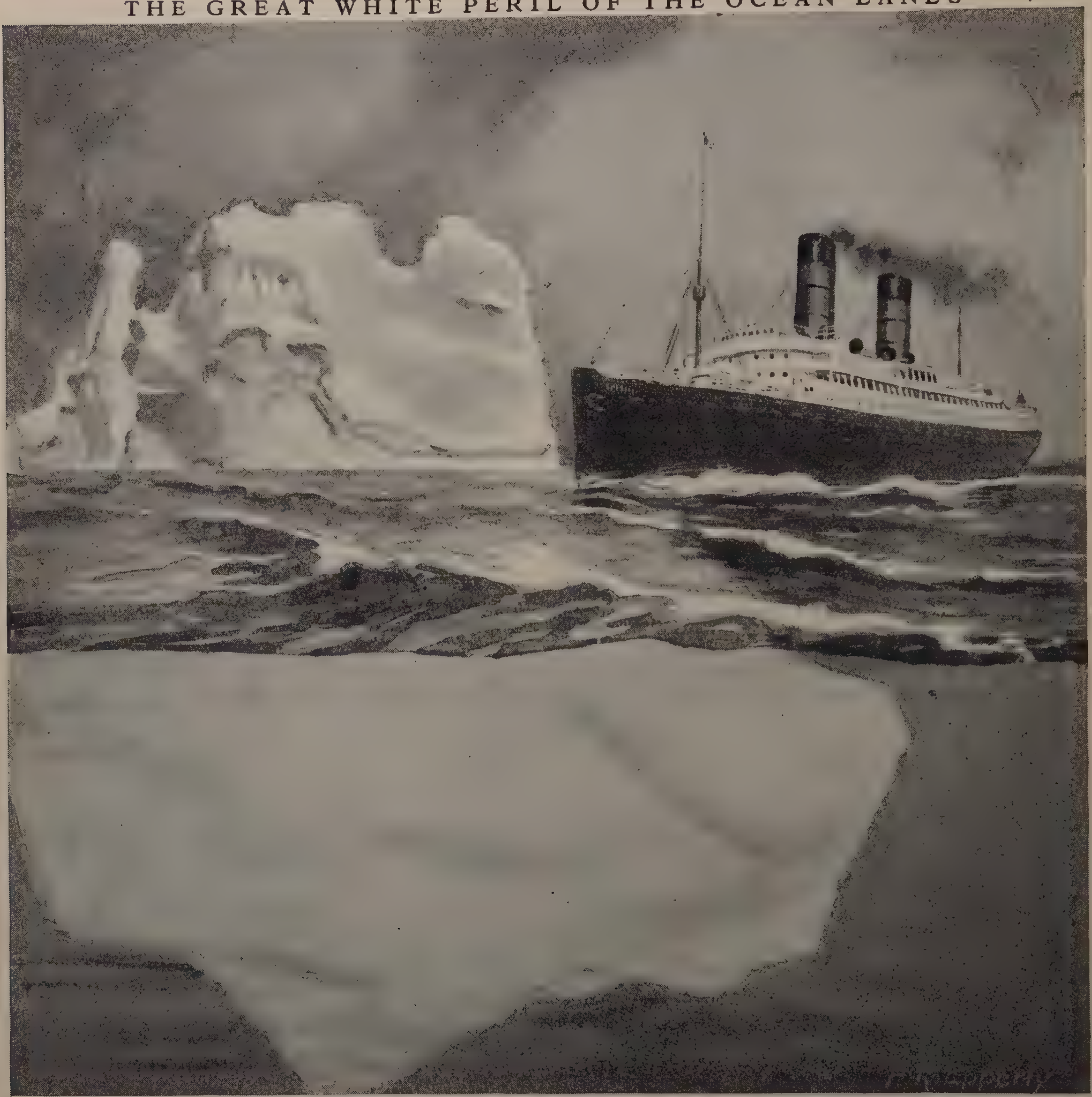
These wanderers of the sea overwhelm the onlooker with their beauty. Over their dazzling surface of solid ice tints of delicate green mingle with blazing sapphire veins, with deep dove-colored caverns carved by hungry waves, and, at dawn and sunset, with glints of purple and azure and rose. As they drift along, now and then breaking, turning, sloughing off great fragments with a tremendous crash, many of them assume fantastic shapes—like castles, triumphal arches, or domed mosques.

Once afloat, icebergs are soon melted by the warmer ocean water and the sun. Some bergs, however, are so huge that they travel 2,000 miles or more before wholly disappearing.

New icebergs are being formed constantly. Some Arctic glaciers have been estimated to furnish as much as 200,000,000,000 cubic feet of ice to the sea each year in the form of icebergs. Most bergs in the north Atlantic come from Greenland's great ice cap. Here in early spring a great procession of floating ice islands begin their journey southward and somewhere around April, May, or June they reach the northern Atlantic steamer routes.

Two routes are particularly dangerous during the iceberg season: one through the Straits of Belle Isle into the Gulf of St. Lawrence; the other by way of the

THE GREAT WHITE PERIL OF THE OCEAN LANES



The giant liner 'Titanic' with over two thousand persons on board, was plowing her majestic course through the Atlantic on the fatal night of April 14, 1912, when she struck the underwater shelf of an iceberg, and two hours later sank to the bottom of the ocean, sucking down all but 706 of her passengers and crew. Notice how small a proportion of the whole mass of ice is above the water, only about one-ninth of the iceberg's bulk. It is this that makes these floating islands so dangerous to passing vessels.

"Grand Banks." Sailors do their best to avoid the bergs by taking more southerly routes. The United States Hydrographic Bureau issues monthly charts locating the principal groups of bergs, and these help the sailors to determine their paths of travel. At night the bergs glow with a peculiar whiteness called "ice blink," due to the reflection of scattered rays of light from the sky on the white surface of the ice. Often the presence of birds far from land or the absence of waves means that floating ice is near, as does the sudden echo from a whistle or a horn. On foggy days bergs may loom up darkly against the white shadowless fog particles. No reliance can be placed on ordinary measurements of either air or water temperature as a means of detecting the nearness of a berg, but a microthermometer for recording one-thousandth of a degree has been recently invented which is expected to prove valuable in detecting icebergs. (*See* Glacier.)

ICELAND. As a little shipload of Norse colonists neared the unknown shores of Iceland in 874 A.D., their hearts beat fast with wonder and joy at sight of the Arctic sun glittering on snow-clad domes, towering cliffs, naked volcanoes, and ice-bound waterfalls.

"This oath I make fast," said one of the chieftains, casting the wooden columns of his ancestral hall into the sea, "and swear before these pillars sacred to our gods that upon whatever part of the coast they drift there will we found our colony!"

Today the descendants of these Norsemen, who were seeking escape from the tyrant King Harald, are still to be found in this "island of ice and fire," washed by the Atlantic and the cold blue Arctic Ocean. And the Icelanders today are as plucky as were their ancestors of old. They live in towns and scattered farms along the foggy coasts and the damp sheltered valleys of the fiord-indented lowlands, for only this one-seventh of their island is habitable. Many are the anxious glances they cast behind them at the rugged table-lands, a region of lava deserts, sand wastes, giant glaciers, and mammoth waterfalls—larger than any in Europe. For in this weird hinterland are boiling mud springs and geysers which hurl torrents of water high in the air, while more than a hundred great volcanoes tower in the background with a regiment of ice-clad peaks. From these come stupendous eruptions and earthquakes that wipe out great tracts of cultivated land and often take a horrible toll of lives. The Icelander still shudders when he thinks of Mt. Laki's

THE ICELANDER AND HIS NATIVE LAND

In the upper picture we are looking down a business street in Reykjavik, the capital of Iceland. Reykjavik has substantial and attractive business houses and homes built of brick and painted white. It is a busy city of 15,000 people, exporting cod and herring. It has fine public schools. The lower picture is a scene on the northern coast of Iceland. At the base of the mountains is a little fishing and whaling village. This fine old gentleman is a typical native of Iceland.

YOUNG ICELANDERS

One, two, three, four, five, six little Icelanders all in a row! And everyone of them is a "towhead"; for they are Scandinavians, remember.

activity in 1783, which destroyed four-fifths of Iceland's live stock, devastated much of the land, and together with the resulting famines and epidemics killed over one-fifth of the population.

Although the surrounding oceans make Iceland warmer than its latitude (63° 12′ to 66° 33′ N) would suggest, the climate is nevertheless raw, cold, and variable — often snowy—the year round. And Iceland folk for the most part can earn their monotonous living only by tending small crops of hay, potatoes, and turnips, by watching over cattle, sheep, goats, and little Iceland ponies that graze in scattered pastures, and by fishing in stormy seas for cod, herring, and shark. Sea harvesting gives the Icelander the greater part of his exports; his cod fisheries are among the most important in the world, attracting many foreign fishermen. Tallow, wool, hides and skins, sheep and horses, salted meat, and eider-down are other exports. The trade is chiefly with Denmark, Great Britain, Norway, and Sweden. There are no manufactures. The mineral wealth (which includes Iceland spar, a transparent variety of calcite used in making optical instruments) remains largely undeveloped.

Despite all handicaps the Icelanders are a sturdy, law-abiding, and progressive people. Educational standards are high, and more books are printed and sold in proportion to the population than in any European country. Iceland has also had prohibition and woman suffrage for many years.

The Icelandic language is closely related to the old Anglo-Saxon. Because the country is shut off from other lands, Icelandic has changed so little from the language of the early Norse settlers that even the little children can read the fascinating ancient sagas of old Icelandic heroes, some of which rank as masterpieces of literature. In the present day Iceland still has distinguished literary representatives, particularly in poetry, drama, the novel, and translations.

Iceland lies 150 miles east of Greenland and 500 north of Scotland. With its area of almost 40,000 square miles, it is one-third the size of Great Britain. Only about ¼ of one per cent is under cultivation. Its history begins with its settlement by Norse colonists in the 9th century. In 1264 it was annexed to Norway; and later fell with Norway under Danish domination. Since 1918 it has been an independent state, united with Denmark only through having the same sovereign. Its capital, Reykjavik, has a population of 15,000. Population of Iceland, about 92,000.

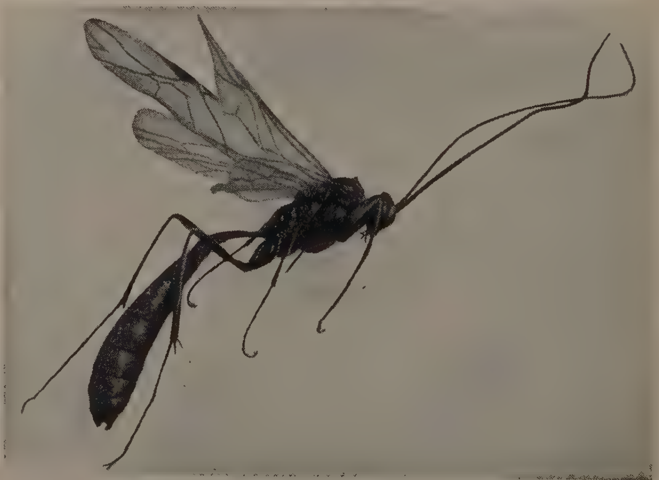
ICHNEUMON (*ĭk-nū′mŏn*). The common name for a number of small weasel-shaped mammals of North Africa. The East Indian representatives of the group are called "mongooses" (*see* Mongoose). The Egyptian ichneumon (*Herpestes ichneumon*) ranges over Egypt and the north of Africa, where it is known to foreigners as "Pharaoh's rat"; it also occurs in the south of Spain. It eats the eggs and young of reptiles and birds. Because of its fondness for rats and mice it is often domesticated.

ICHNEUMON FLIES. These beautiful flies, with their four gauzy wings, are invaluable allies to the farmer. They destroy the young or larvae of many harmful insects, such as the army-worm and the tussock-moth, by laying eggs in their bodies. When the larva of the ichneumon fly hatches, it slowly eats its way into the other larva and thus kills it.

Ichneumon flies vary in size, but all have long slender abdomens with long legs which trail gracefully as the insect flies through the air. From the abdomen of the female extends a thread-like egg-laying organ called an "ovipositor" (egg-depositor). In some species this organ reaches the amazing length of eight inches.

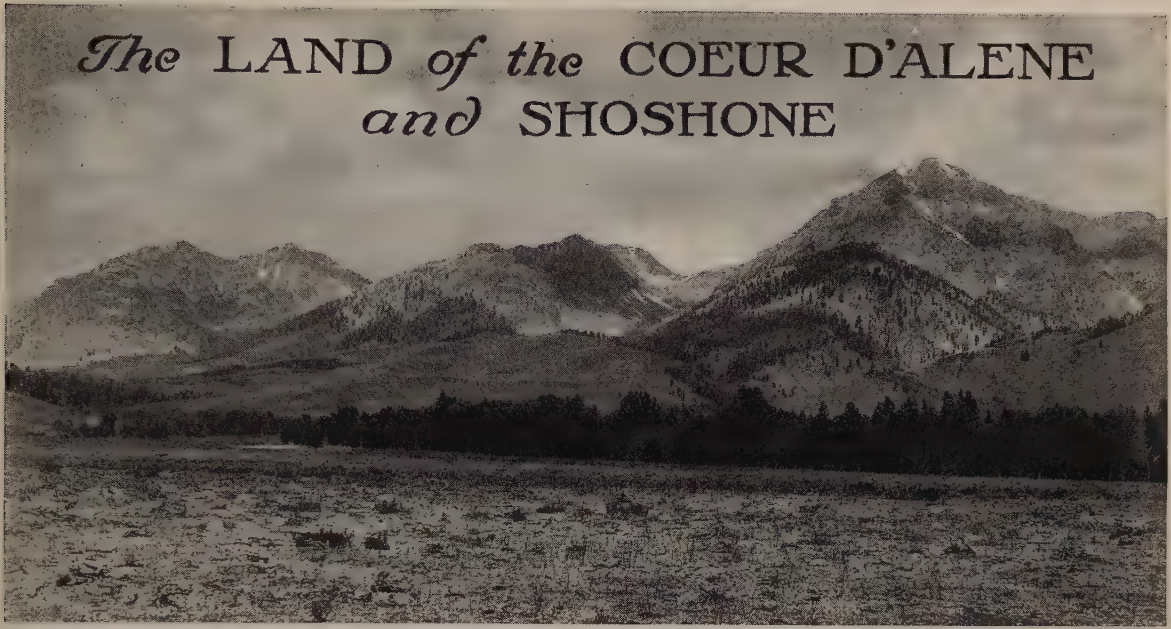
Scientific name, *Ichneumonidae;* order, *Hymenoptera* More than 650 species have been described. One of the largest in America is the *Thalessa*, which measures 10 inches from the tip of the antennae to the tip of the ovipositor.

THE DREAD FOE OF OTHER INSECTS



The Ichneumon Fly, shown above, lays eggs in the larvae of other insects, and the young Ichneumon grub soon kills its host.

The LAND *of the* COEUR D'ALENE *and* SHOSHONE



Mountain scenery like this earned Idaho its name, which means "Gem of the Mountains." Here you see the forests growing in evergreen masses, and above them the snowy crests that feed the clear flowing streams and the magnificent waterfalls. And somewhere back there in the mountains you are sure to find beautiful sparkling lakes.

Extent.—North to south, 485 miles; east to west, from about 45 miles on the northern border to 310 miles on the southern border. Area, 83,888 square miles. Population (1920 census), 431,866.

Physical Features.—Coeur d'Alene, Bitter Root, and Salmon River Mountains (highest point, Hyndman Peak, 12,078 feet). Principal rivers: Snake (Shoshone Falls, 190 feet), Salmon, and Clearwater. Lake Pend d'Oreille.

Principal Products.—Hay, wheat, oats, sugar beets, and potatoes; cattle, sheep, wool, and dairy products; lead, silver, copper, gold and zinc; lumber and timber products, flour.

Chief Cities.—Boise (capital, about 22,000), Pocatello (15,000).

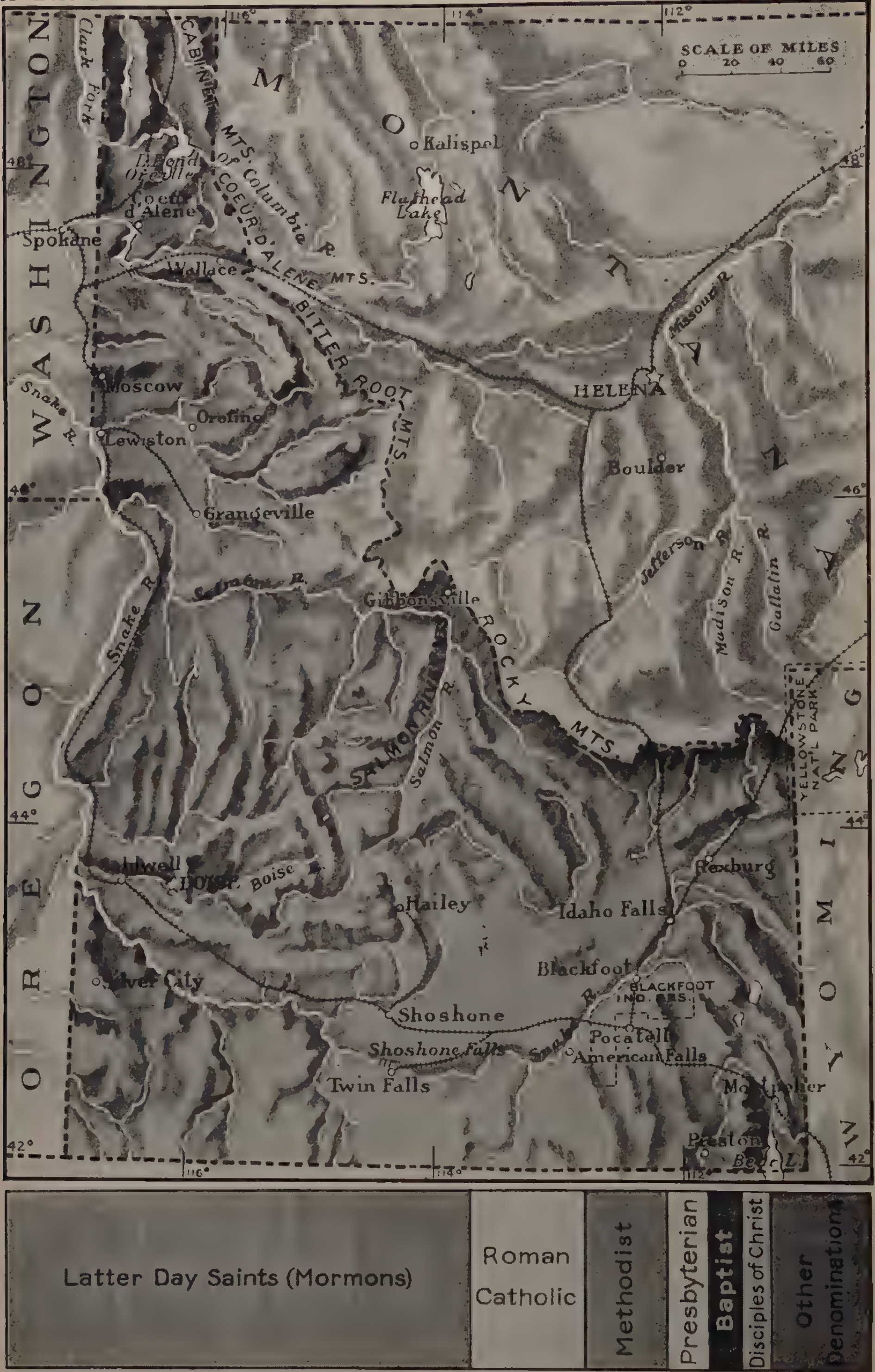
IDAHO. Because of its wild and romantic beauty, the Indians gave the name "Idaho," meaning "Gem of the Mountains," to the region now comprised in this state. The more realistic pioneer settlers called it "The Panhandle State" because of its unusual shape. Idaho is one of the states carved out of the Oregon country, the title to which was settled by treaty with England in 1846. Starting east of Washington with a boundary of only 45 miles on the Canadian border, it follows the line of the Cabinet, Coeur d'Alene, and Bitter Root mountains, thrusting southeast along the border of Montana until it reaches a width of 325 miles between Oregon and Wyoming.

Scarcely anywhere in the United States are there mightier mountains, greener meadows, fatter farms, or a more generous store of fine and precious things than in Idaho. The face of the country is rough with mountains, spangled here and there with small bright mountain lakes, and many of its streams glide to the sea between the deep lips of long canyons—the poet's "waters between walls of shadowy granite, in a gleaming pass." Heavy forests grow in evergreen masses on the sides of the snow-crested ranges, and the clear streams flung down their sheer rocky sides make long white waterfalls that rival Niagara in grandeur. Shoshone Falls, where the Snake River plunges 190 feet into a dark-green lake at the bottom of a deep gorge, is exceeded in magnificence only by the falls of the Niagara and Yosemite. This incalculable supply of water power is one of the state's greatest assets and is being more and more used to turn wheels and to make electricity for the state. Water-power plants have been developed at American Falls, Minidoka Dam, Arrow Rock Dam, Shoshone Falls, Swan Falls, Salmon Falls, the Thousand Springs, and Twin Falls.

On the slopes of the low round foothills are spread fields of wheat, oats, and alfalfa; and vegetables and fruits grow in the fertile valleys. Cattle graze in the tall grass of the upland valley meadows and on the wide plateaus. Geologists come from far away to study the lava beds of central and southern Idaho, which were poured down long ago from volcanoes now old and dead, and which the rain and frost and winds of millenniums have broken up into a soil of unusual fertility. And sick people come to the healing waters of the hot and mineral springs, which are so numerous that water piped from warm springs is used in winter to heat houses in Boise, the capital city. Other springs supply water almost ice cold all summer long. Currents of cold air from deep wells are used on many farms for refrigeration.

Mountainous Idaho, lying at so many different altitudes beneath the northern sun, necessarily has a widely varying climate. The southern and central sections are arid, with practically no rain in the summer, but with heavy snowfalls in winter. In the higher regions the winters are long and severe, but the lower valleys, sheltered by the Rockies and swept by winds from the Pacific, have mild winters. Even

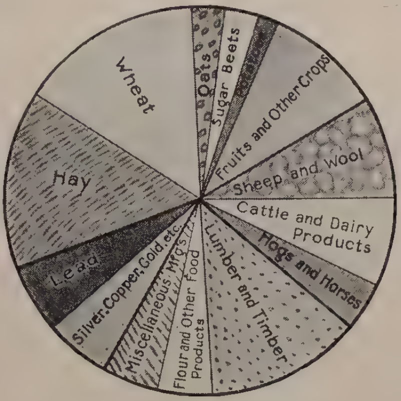
A LAND OF WEALTH IN MOUNTAIN, FOREST, AND STREAM



Notice, first, Idaho's peculiar shape which brought it the nickname of the "Panhandle State." Next see what a great number of rivers course through the valleys lying between the mountains that furrow nearly the entire state. Along the course of the great Snake River have been built some of the greatest irrigation projects in the country, adding to the wealth of Idaho's forests and mines the products of countless irrigated farms. Below the map the religious denominations of the state are compared.

some of the higher valleys are so sheltered that cattle can roam throughout the winter, and spring comes back to parts of Idaho long before it reaches some states lying in latitudes far more southerly.

A few rivers to the north flow off into the Columbia, but most of the state is drained by the long curves of the Snake River, winding in a tremendous canyon for 350 miles across the southern part of the state and for 200 miles along its western boundary. Much of this precious water supply, and also that of the crystal mountain lakes, is being developed for irrigation, particularly on the great intermountain plateau along the course of the Snake. Here are some of the largest irrigation systems in the country, with great dams and reservoirs and more than 10,000 miles of canals costing in the neighborhood of $100,000,000. Thus what was once a frowning desert has been transformed into the best farming land of the state. Wheat, alfalfa, timothy, and oats grow here luxuriantly, as well as in the fertile northern valleys where no irrigation is needed; in the arid southeast especially fine macaroni wheat is raised by dry farming. Sugar beets and potatoes are also important crops. The northern valleys are also famous for their fine orchards of prunes, apples, apricots, pears and peaches. Idaho has been one of the greatest sheep-raising states, ranking with Texas and California in numbers of sheep, and numerous herds of cattle have roamed its plains, but the newer dairy industry now bids fair to rival even sheep raising.



Sources of Idaho's Wealth

Another enormous industry is that of lumbering; more than a third of the area of the state is covered with forests, most of them under national control. The lumber mill at Potlatch is said to be the largest in the United States and the second largest in the world. The white pine forests in northern Idaho are among the largest in the world as well as the most valuable, and the lumberers also have great fragrant stretches of red fir, Douglas fir, yellow pine, spruce, hemlock, and juniper to draw on; there is even a little hardwood to be had in the forests of black cottonwood which grow to the north in the valleys and around the marshy lakes. Vast fortunes have been made from Idaho timber.

THE CAPITOL BUILDING AT BOISE

Boise, the capital of Idaho, stands on the site of a former fur trading post of the Hudson's Bay Company. A United States military post was established here in 1863, and the next year the city was organized as the capital of the territory. The famous Arrow Rock Dam 27 miles away, provides electric power for the city as well as irrigation for the rich surrounding territory.

Another source of Idaho's wealth is her mineral deposits. In some sections the Idaho earth is threaded with gold, silver, lead, zinc, copper, coal, cobalt, and building stone. In silver and lead production Idaho is among the leading states. The arid southeastern plateau contains perhaps the richest deposits of phosphate rock in the world.

Aside from the products of the sawmills and planing mills, and the beet sugar factories, the flour and grist mills, and the dairies, the state has developed no important manufactures; though concrete, packed meats, and fruit drying and canning are growing industries.

The first white men known to have explored Idaho are Lewis and Clark (*see* Lewis and Clark Expedition). Settlement was slow, until the discovery of gold and silver, in 1860, started a rush of prospectors to the Boise basin. Three years later the region was organized as a territory, including Montana and part of Wyoming. The creation of those two states later left Idaho with its present irregular outline. By 1890 it had a population large enough to be admitted into the Union as the 43d state.

Occasional Indian outbreaks harassed the early settlers, but in 1877 all the Indians had been driven to the reservations provided for them. Like Nevada, Idaho received many Mormon settlers, who came in such numbers that 40 per cent of the population today is Mormon. In 1883 the legislature deprived the Mormons of the right to vote, but 10 years later, when the Mormon church gave up the principle of polygamy, all Mormons with one wife received the franchise again. From 1892 to 1899 a number of serious mine strikes occurred. In 1905, Gov. Frank Steunenberg, who had opposed the miners, was assassinated.

RICH INDUSTRIES AMID BEAUTIFUL SCENERY

This is the great lumber mill of the Potlatch Lumber Company at Potlatch, Idaho, which helps to turn into lumber the fine trees of the great forests which cover a third of the State. This mill is said to be the largest in the United States.

In this mill at Morning Mine, Mullan, Idaho, a thousand tons of ore are crushed daily and so reduced to the form in which the ore can be handled by the smelter where the lead and silver are melted out.

At the Shoshone Falls, the waters of the Snake River take a sudden plunge of nearly 200 feet. These falls for their impressive beauty have been compared to those at Niagara.

IDAHO WOOL "ON THE HOOF"

What a lot of nice woolen clothes and dresses and blankets and things are going about here on four legs, cropping close the grass of the Idaho plains! This is a snapshot of part of a flock of 37,000 sheep owned by one of the big ranching companies of Idaho. This state ranks with Texas and California as one of the great sheep-raising states.

Idaho's recent history has been less turbulent, as the agricultural population has increased. Although the state's rate of growth has been rapid—it doubled its population every decade from 1870 to 1910—it is still thinly settled. Twice the size of Ohio, it has less than one-tenth the population. Little more than 10 per cent of the state's area of about 84,000 square miles has been brought under cultivation, so that its possibilities of development, under irrigation and modern dry-farming methods, are still great. Politically Idaho has been distinguished for its progressiveness, giving the franchise to women in 1896, introducing the initiative, referendum, and recall in 1912, and state-wide prohibition in 1916. By the state constitution all the waters of the state are reserved for public use.

Boise, the capital, lies in the southwestern corner of the state on the Boise River. The state university is at Moscow, about 200 miles north of Boise on the Washington border. State normal schools at Albion and Lewiston, a technical institute at Pocatello, and an Industrial Training School at St. Anthony, are some of the other educational institutions of the state. The state maintains a school for the deaf and blind, an orphanage, and two insane asylums.

IGUANA (*ĭ-gwä'nȧ*). This fantastic family of lizards, great and small and varying widely in appearance, is found altogether in North and South America, except for two genera in Madagascar and one in the Fiji Islands. Their curious teeth, round at the root and sawlike at the tips, are the distinguishing characteristic. Typically, too, they have a large dewlap or pouch under the head and neck and scaly crest running down the back from the neck to the end of the long slender tail. Most of them are green and live among trees; some have the power of changing their colors apparently at will.

The great Galapagos sea-iguana—four or five feet long or more—spends most of its life in the water. It has slightly webbed feet and feeds on seaweed. The Galapagos land iguana is a stout lazy creature, which feeds on the foliage of trees. The large common iguana of Central and South America—a green tree lizard—is hunted by the natives for its white delicate flesh which resembles chicken. The rhinoceros iguana of San Domingo has two horns on its nose. Even more frightful in aspect, though as harmless as other iguanas, is the helmeted or hooded basilisk of Central America, with its wicked-looking crest on head and back. (*See also* Lizards.)

IRRIGATION PRODUCTS

Here are three examples of the good things the soil of Idaho produces—much of it land that used to be classed in the old geographies as part of the "Great American Desert." It has been transformed by irrigation. Apples, wheat, and potatoes from Idaho are of exceedingly fine quality.

In the HEART *of the* UNION — *the* "PRAIRIE STATE"

ILLINOIS. "The center of population, now in Indiana, is traveling straight towards the middle point of Illinois. The center of manufacturing has reached as yet only eastern Ohio, but it is marching in a beeline for Chicago." This, it is said, is the boast of the people of the "Prairie State"; and it is not without foundation. Illinois stands near the middle point of the continent, binding North to South and East to West. Its chief city, Chicago, is the metropolis of the Middle West and the second city in size in the country. Transportation lines from all directions center here, and give Illinois more miles of railway than any other state except Texas.

Extent.—Greatest length, north to south, 385 miles; east to west, 218 miles. Area, 56,665 square miles. Population (1920 census), 6,485,280.

Physical Features.—Level or rolling prairies, with an offshoot of the Ozark ridge in the extreme south and low hills in the north. Principal rivers: Illinois, Rock, and Kaskaskia, tributaries of the Mississippi; Embarrass and Little Wabash, tributaries of the Wabash. Lake Michigan at northeastern corner.

Principal Products.—Corn, oats, wheat, hay, vegetables; swine, horses, cattle; meat products; foundry and machine-shop products, agricultural implements, railway cars, clothing; coal, petroleum, zinc, limestone and sandstone, portland cement, clay products.

Chief Cities.—Chicago (over 2,700,000), Peoria (77,000), East St. Louis (67,000), Rockford (66,000), Springfield (capital, 60,000), Decatur (45,000), Joliet, Aurora, Quincy, Rock Island, Danville, Elgin, Bloomington (over 25,000).

But if Illinois owes much to its position, it owes no less to its great resources. Three-fifths of its area is underlain with productive deposits of coal, making it third in coal production among the states. The entire state is covered with rich well-watered lands that make it second only to Iowa in corn production, and near the head in wheat, oats, and hay. Not only does it contain the biggest meat-packing center in the world, but it also produces swine, cattle, and sheep in great numbers. The most remarkable feature about Illinois is that while it holds third rank in manufactures, and second or third in mineral production, it has occasionally surpassed all other states in the total value of its agricultural products. Since 1890 it has held first place in the value of its farm lands.

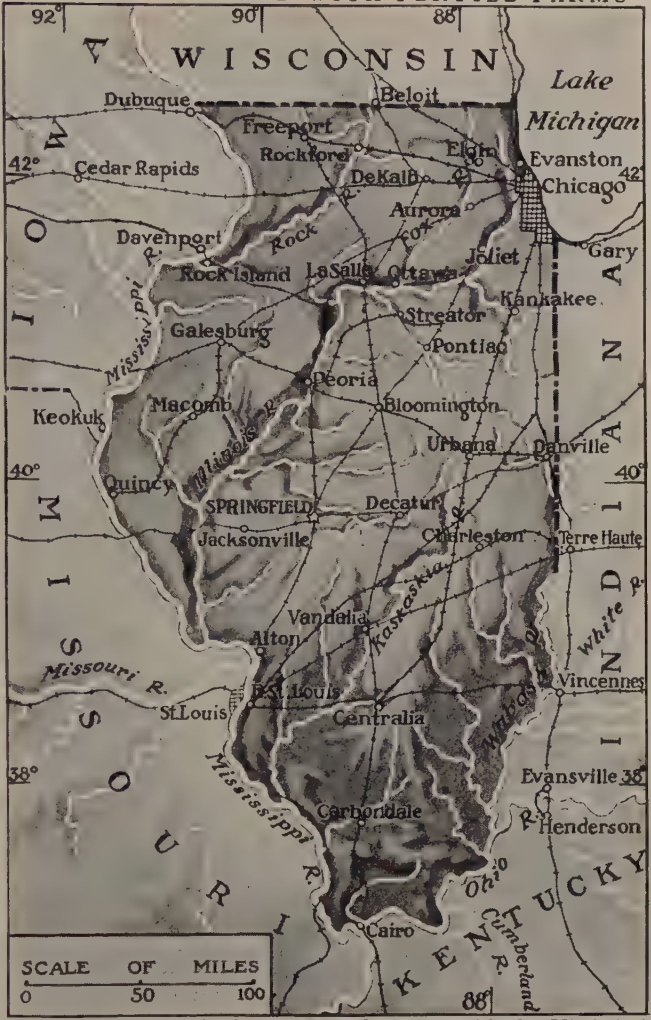
With its gradually sloping hills and broad shallow valleys, Illinois is one of the most level states in the country. The only considerable eminences are about 50 miles from the southern boundary, where a narrow branch of the Ozark Mountains crosses the state. In the northwest the state reaches its greatest height in hills that rise some 1,200 feet above sea-level; but even these are only a few hundred feet above the surrounding country. From north to south the surface of the land as a whole slopes gently to the lowest point, at Cairo, which is only 300 feet above sea-level.

If a relief map of Illinois shows a land of no mountains, it shows one well covered with rivers. On the east the state touches the vast "unsalted seas" of the Great Lakes. On the west and south it borders for hundreds of miles on two of the greatest navigable rivers of the United States—the Mississippi and the Ohio; and on the east, separating it from Indiana, is the Wabash. Nor is the interior less well supplied. There are more than 275 streams in the state, grouped in two river systems. Three-fourths of the streams flow into the Mississippi, while the others are tributary to the Wabash or Ohio rivers. The most important river in the state is the Illinois, which, formed by the junction of the Des Plaines and Kankakee, drains almost half the state. The early French explorer, Father Marquette, wrote of it: "We have seen nothing like this river for the fertility of the land, its prairies, woods, and wild cattle. It has many little lakes and tributary rivers."

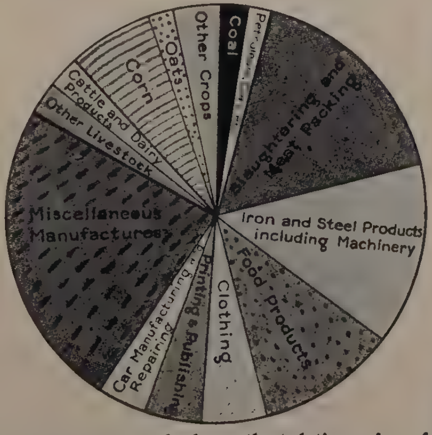
All along the Illinois and other rivers of the state are bluffs of considerable height and steepness, the most noted of which is Starved Rock, which rises from the Illinois River opposite Utica. The view of the countryside from the top of this mammoth rock, 157 feet above the river, and the numerous wooded ravines and canyons extending far up and down the river, is unrivaled in beauty anywhere. The spot is also rich in historic lore. Here the intrepid explorer La Salle built Fort St. Louis as a link in a chain of French fortifications; and here, in after years—if tradition is to be believed—perished the last remnant of the Illinois Indians, driven by their foes to the flat top of the rock, where all but a few died of hunger rather than surrender. The district about Starved Rock has been made a state park. Deer Park Canyon, a few miles away, is another place of great natural beauty and interest.

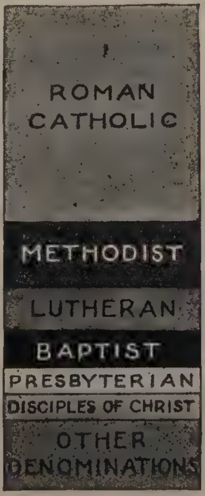
Other state parks are Fort Massac on the Ohio River, the gateway by which George Rogers Clark entered and conquered the British; and New Salem, the home of Abraham Lincoln, located on the Sangamon River not far north of Springfield. It was here that Lincoln kept store, studied law, and was elected to the legislature. The Rutledge Inn, where he boarded, and courted Ann Rutledge, has been restored, along with other historic buildings. Plans are now under way to restore Fort Chartres, near the Kaskaskia River, which was the center of French influence in the Middle West for more than a century. Cahokia Mound, or Monk's Mound, about six miles from East St. Louis, is one of the most imposing monuments of the prehistoric mound builders in the United States, and attracts many visitors annually.

A STATE CROWDED WITH FERTILE FARMS



Illinois' position at the foot of Lake Michigan, with the Mississippi River for its western boundary, makes the state a natural avenue of commerce. This, added to the richness of its soil, explains its great prosperity.





The circular graph shows the relative value of Illinois products. At the right we see how the population of the state is divided according to religious belief.

When the early explorers penetrated Illinois the treeless plains resembled billowy seas of tall grass and beautiful flowers. Forests were found only in the southern part and bordering the rivers in the north. Today both forests and prairies have yielded to the plow, and there is nothing to suggest the name that Illinois still holds—the "Prairie State." More than 90 per cent of its land is under cultivation. One may travel for miles and see nothing but ample farms with comfortable farmhouses, and prosperous middle-sized communities.

These level and extremely fertile farming lands are by far the greatest and most enduring source of the state's wealth. The plow may run for miles without touching a pebble or scarcely a grain of sand. The rich black loam is so fertile that in many places rotation of crops is not necessary. The gentle slopes and fine soil have invited the

PICTURESQUE MEMORIAL OF THE GRIM INDIAN WAR

This is the famous Starved Rock as seen from the Illinois River. From the top of this rock, which stands 157 feet above the river, the eye takes in a charming panorama of wooded ravines and canyons. Looking back into history, we remember that this is the rock on which La Salle built Fort St. Louis and on this level summit gathered the last remnant of the Illinois Indians, fleeing from the Potawatomies, and here they perished from hunger.

introduction of machinery making large farms possible and enormously increasing the production. In some places the flatness of the land has been a handicap, because of poor drainage. Tile drains and ditches remove this difficulty, and make these lands some of the most valuable in the "corn belt." Only Iowa has a greater proportion of land under cultivation than Illinois.

ON AN ILLINOIS STOCK FARM

This picture of a group of Holsteins taken near Quincy is typical of the fine stock farms of Illinois.

Climate and soil permit also of the growing of nearly every crop known in the temperate belt. Even cotton and tobacco are grown to a small extent in "Little Egypt," around Cairo, where the state melts invisibly into Kentucky conditions. But by far the most valuable of Illinois' crops is corn, grown chiefly in the north and central parts of the state. With the exception of one year, Illinois ranked first in corn production for 58 years; then, in 1918, Iowa surpassed it. Together Illinois and Iowa produce more than one-fourth of the corn raised in the whole United States. Wheat is grown extensively in the southern part of the state, and hay and oats are abundant in the north, where dairying is consequently well developed. Oats and hay encourage the breeding of horses, of which there are more than a million, while the corn is used to feed hogs and cattle. Vegetables and other garden products are raised extensively near the large cities, and apples and strawberries are grown in every county.

Coal and iron, the most important minerals in the world, are both readily available to Illinois. Coal is furnished by its own enormous deposits, which underlie most of the state, and cheap water transportation places the rich Lake Superior iron-ore region within easy reach. Illinois ranks high in the production of petroleum and natural gas, which are found in many parts of the state. Clay, used for brick, tile, and other products, is found in every county, and limestone, clay, and shale are

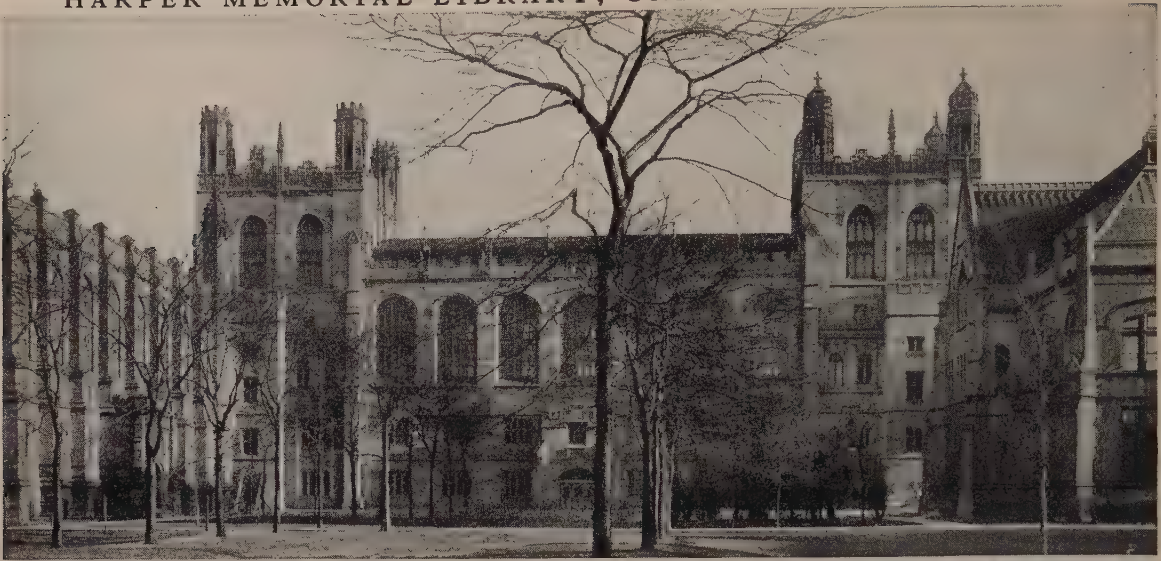
PRODUCTS OF ILLINOIS FARM LAND

Only one other State—Iowa—has a greater proportion of land under cultivation than Illinois. The upper picture shows a field of grain in the southern part of the state, and in the lower picture you see a group of giants of the corn field. Illinois and Iowa together produce more than one-fourth of the corn raised in the United States.

extensively used in the manufacture of portland cement. Illinois produces more fluor-spar (used chiefly in the smelting of iron) than any other state. It also has some zinc and lead mines in the vicinity of Galena.

Manufactures and industry on an enormous scale are the result of the cheap and plentiful coal, combined with easily accessible iron. Cyrus McCormick established his harvester factory in Illinois, and today there is scarcely a place in the civilized world where you will not find agricultural implements made in Illinois. Meat-packing is the most important single industry. The stockyards and packing establishments of Chicago are, indeed, the greatest in the world; and about this industry and the grain trade, for which also Chicago is a world center, have grown a number of related industries dealing with the preparation and marketing of food products. Just to the south of Chicago, and in many other cities, are important steel mills. The state ranks high also in the manufacture of watches, furniture, musical instruments, soap, and men's clothing.

Because of the importance of agriculture, mining, and manufacturing in the state, Illinois is great in commerce. Its central location, its level surface, and the forced direction of east-and-west railroads around the southern end of Lake Michigan, account for the number of railroads in the state. Illinois also holds the best position among the states for inland water transportation. More than 6,000 vessels arrive at and depart from the great harbor at Chicago every year, a larger number than at any other Great Lakes port. The Mississippi, Ohio, and Wabash rivers furnish more than 800 miles of navigable waters on the borders of the state, and the Illinois River is navigable to La Salle, where it is joined by the Illinois and Michigan Canal, which extends to Chicago. Before the development of railroads this canal was of great importance, but at present it is little used. The Chicago Drainage Canal, however, built primarily to carry away the sewage of Chicago so that the waters of Lake Michigan should not be made unfit for use by the city, is capable of carrying lake boats to Lockport, HARPER MEMORIAL LIBRARY, UNIVERSITY OF CHICAGO



This is the Harper Memorial Library of the University of Chicago, named in honor of Dr. William Rainey Harper, the remarkable man to whose energy, vision, and organizing ability the success of this great institution of learning is largely due. Like the other buildings in the great quadrangle, it is in the Gothic style and of gray limestone. The nucleus of the Library, a collection of 175,000 volumes carefully selected, was purchased in Berlin soon after the University was organized.

a distance of 36 miles from the lake. Here the canal empties into the Des Plaines River, which flows into the Illinois. The state is now working upon a project to deepen these rivers so that large vessels can ply between Chicago and New Orleans. The plan includes extensive developments in the existing electric power plants along the route.

Almost half the population of Illinois lives in the region about Chicago, the residential suburbs of which stretch northward for many miles along the lake bluffs. Chicago is the fourth city in size in the world, and second to New York in the United States both in size and the value of its manufactures (*see* Chicago).

THE ILLINOIS STATE CAPITOL

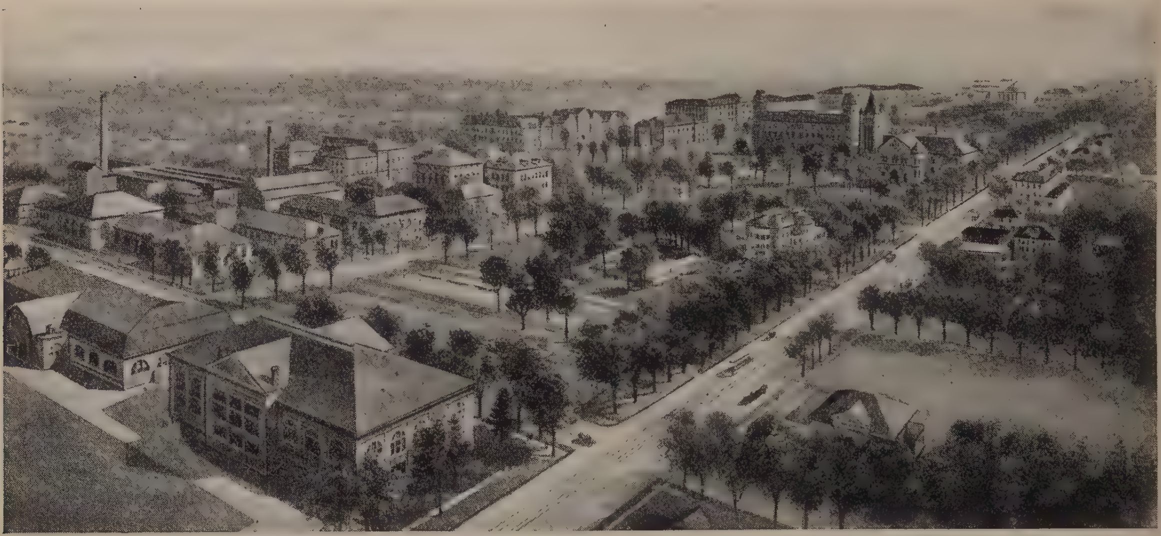
This is the building in which the laws of the State of Illinois are enacted—the imposing Capitol in Springfield. It is built in the form of a Greek cross with porticoes of granite. It was begun in 1868 and took twenty years for its completion at a total cost of over $4,000,000. This is the fifth capitol building in the history of the state and the second built in Springfield.

The second city in Illinois is Peoria, situated near the center of the state on an expansion of the Illinois River called Peoria Lake. Surrounded by a rich agricultural region, with excellent transportation by rail and water, Peoria has a great wholesale and retail trade; and its proximity to coal beds makes it the second manufacturing city in the state. Its chief manufactures are corn products (syrup, starch, glucose, breakfast foods, etc.), dressed meats, agricultural implements, and watches. It also trades extensively in fish, caught in the waters of the Illinois.

SOME GREAT ILLINOIS INDUSTRIES

These pictures show some of the industrial enterprises upon which rests the prosperity of Illinois. Add to these the products of the fertile farms and you have the combination which, with its central location and abundant means of transportation by land and water, makes that state one of the richest in the Union.

THE GROUNDS OF THE STATE UNIVERSITY



The grounds and buildings of the University of Illinois occupy 610 acres between the cities of Urbana and Champaign. This is now one of the best known universities in the country, and rivals the University of Chicago in the rapidity with which it has developed. It is broad in its scope, comprising colleges of Liberal Arts and Sciences, Engineering, Agriculture, Law, Medicine, Dentistry, Library Science, Music, and a School of Education.

Springfield, the capital of Illinois, is a beautiful city laid out with wide and well-shaded streets, with the public square and courthouse in the center. The State Capitol is one of the finest public buildings in the West. Located in a rich agricultural district, it is an important railroad center from which large shipments of coal, grain, and live stock are sent out. Its chief manufactures are steel and lumber products, flour, shoes, and paving brick.

East St. Louis, situated on the Mississippi River opposite St. Louis, Mo., is connected with that city by great steel bridges. It is the terminus of many railways from north, east, and south, and its industries include packing houses, rolling mills, glass works, and flour mills. Other important cities are Rockford, one of the great furniture-making centers of the United States; Elgin, famous for the manufacture of watches and clocks; Joliet, which contains some of the largest steel plants in the country; and Decatur, Aurora, and Quincy, important manufacturing cities.

No state, except New York and Pennsylvania, spends more money for educational purposes than Illinois. In addition to its many elementary and preparatory schools, at which attendance is compulsory for all children between the years of 7 and 14, the state maintains a state university at Urbana, and five normal schools at Normal, Carbondale, Charleston, DeKalb, and Macomb. The University of Chicago, founded by John D. Rockefeller (*see* Chicago) and Northwestern University, at Evanston, are also well known institutions.

The state government follows the usual American pattern. Its administrative functions, however, were greatly improved in 1917, when various scattered boards and commissions were grouped into nine departments and 100 executive offices abolished.

The first white men to see what is now Illinois were the French explorers and missionaries from Canada. Father Marquette and Louis Joliet visited the region in 1673; and Joliet, La Salle, and Tonti visited it again in 1679. The French called the country "Illinois" after the "Illini" or "Iliniwek" confederacy of Algonquian Indians, who lived about the Illinois River. In 1680 La Salle and Father Hennepin established the first Christian missions there. Kaskaskia, Cahokia, and Fort Chartres, all on the Mississippi River, became important French trading posts.

In 1763, by the Treaty of Paris, the Illinois country passed to Great Britain. When the Revolution came, George Rogers Clark and his intrepid Virginians, in 1778, wrested the region from the British. In 1787 it was organized by the United States Congress as part of the Northwest Territory. In 1809 the separate Territory of Illinois (including parts now included in Wisconsin, Michigan, and Minnesota) was organized. On Dec. 3, 1818, Illinois was admitted as a state with its present boundaries. The last conflict with the Indians, called the Black Hawk War, occurred in 1831–32.

The first state capital was at Kaskaskia, the second at Vandalia. In 1837 the capital was removed to Springfield, where it has since remained. During the Civil War Illinois gave to the nation Abraham Lincoln and U. S. Grant, besides furnishing its full quota of troops in the field. The state also played a prominent part in the Mexican and Spanish-American wars, and responded with enthusiasm when the call to arms came in the World War.

LITTLE TALKS ON GREAT THINGS

by Arthur Mee

IMAGINATION

IS NOT imagination the greatest thing in all the world? Is it not at the very heart of all the great things that men have ever done?

Did imagination not give us America? Far back in the centuries this continent was an idea in the minds of some Viking sea-rovers—it was a piece of imagination. Once again it was an idea in the mind of a boy standing in the harbor at Genoa to watch the ships go out—it was part of the imagination of Columbus. Still again, the idea of a great free republic on a continent almost unknown was an idea in the minds of a hundred people who fled from the tyranny of James Stuart in England—it was part of the imagination of the Mayflower men. So, if we think of it, the whole of today is part of the imagination of yesterday, and tomorrow is the imagination of today.

Think of the men who work in things unseen—the great kings of science who peer into the invisible, who weigh the earth and measure the stars, who ponder over the mystery of life itself until they seem to be almost solving it, when the secret slips away and men still ask where life came from and where it goes and what it means. Will they find it out one day? The little crystal that the chemist makes—will it one day come alive? Will these men give us longer life, or kill disease, or drive back death? So the events of every hour thrill the imagination of whoever is not deaf and dumb and blind.

What are pictures and music and books if they do not stir the imagination within us? We listen to the mighty dramatization of sound that we call Handel's 'Messiah', and feel the power and grandeur of great natural forces. We look on the materialization of a vision that we call Raphael's 'Transfiguration', and we feel stirring within us the spirit of the solemn scene it represents. We read the immortalization of piercing anguish in Mrs. Browning's 'Cry of the Children', and we feel ourselves back in another age, listening to the beating hearts and sobs of little ones whose graves have been green these many years. The old, old story that thrills us as we sit remembering by the fire, the book that stirs the mind and opens up another world of thought to us, the picture on the wall that grips the heart as in a vice—what are they but examples of imagination working in us across the earth and through the years? They carry the mind to far-off places and to other days.

Do we not all understand, when we are reading a great story or a beautiful poem, that we have jumped up behind a genius, as it were, and that he is taking us for a ride on his winged horse, Imagination? And do we not also understand that if we ourselves have not a great imagination in our souls we could never enjoy that magic ride? There are those who cannot read poetry, who see nothing beautiful in Nature. Poor, dreary souls! They have no imagination. Without imagination we lose half the fun and all the truth and all the beauty and all the glory of human life.

Somebody has said that a child takes up a twig and calls it a king, and it is true that the imagination of a child is a supreme and wonderful thing. A child knows better than all the grown-ups in the world that this beautiful and romantic earth is not the real thing, that there is in fact a much more beautiful and much more romantic world all about us if we have eyes to see it and imagination to enter into it.

Poets have the same feeling. Keats said that "pleasure never is at home," and bade us "open wide the mind's cage door," so that imagination might fly away with us to the true world of beauty and delight. Wordsworth spoke of human life as the shades of a prison, and said, in those noble words that will not die:

Our birth is but a sleep and a forgetting:
The soul that rises with us, our life's Star,
    Hath had elsewhere its setting,
    And cometh from afar:
    Not in entire forgetfulness,
    And not in utter nakedness,
But trailing clouds of glory do we come
    From God, who is our home:
Heaven lies about us in our infancy!

That heaven of the child is the imagination that stirs within him; and for all of us, as we come into this world and move through it in joy and sorrow, the power of imagination to shape our destinies and bring us happiness is infinite beyond all words. He is rich who, knowing little, has a great imagination; he is poor who, knowing much, has none.

IMMIGRATION. The United States is the most important immigrant receiving country in the world. The English made their first successful settlement in America at Jamestown, Va., in 1607, in what was then a wilderness occupied only by Indians. Although several hundred thousand Dutch, Swedish, and German settlers came to America in the 18th century, the great bulk of the immigrants down to 1820 were English-speaking. Thousands of negroes, also, unwilling immigrants, were brought in as slaves.

IMMIGRANTS ON THE WAY TO THE "PROMISED LAND"

For more than a century the United States has offered refuge to the oppressed and an opportunity to the ambitious people of Europe. Such scenes as that pictured above are in normal times familiar occurrences at many of the great ports. On the eve of the sailing of every great liner bound for America hundreds of immigrants gather on the dock to take passage in the steerage. They are old and young; they have come from the tenements of Naples, bleak marshes in Finland, Hungarian wheat fields, and the "pale" of Moscow; they speak dozens of different languages and dialects; and they represent half a dozen different faiths; nevertheless, they have one great common interest. Each one is coming to America, the "Promised Land." Here he may work in a roaring steel mill, sell fruit on the street corners, or tend long rows of sugar beets, but whatever the task that awaits him, it is the goal of his weary journey, a chance to succeed.

Shortly after 1820, white immigration began in increasing numbers from other lands in Europe. A potato famine in Ireland in 1846 caused a large migration of Irish to America. Germans came because of religious oppression, hard times, and unsuccessful revolution (in 1848) in Germany. The discovery of gold in California attracted thousands of fortune-seekers. After the Civil War, Swedes, Danes, and Norwegians came, until the total from these countries reached hundreds of thousands annually.

Down to about 1885, immigration was almost entirely from the countries of northwestern Europe. Then an influx from southeastern Europe began. From Italy, Poland, Austria-Hungary, Bulgaria, Greece, Russia, and other eastern countries they came in steadily increasing numbers. Of the 1,200,000 immigrants who entered the United States in the year 1913-14—the last year preceding the World War—296,000 were Italians, 278,000 from the varied peoples of Austria-Hungary, 255,000 from Russia, 85,000 from the Balkan States (including Rumania), 106,000 from the British Isles, and 79,000 Germans. During the World War (1914-18) immigration was checked.

The earlier immigrants came to the United States with no other thought than to make America their home. They were glad to become citizens of the promising new country and to devote their energies to its betterment. But many of the later arrivals came with no desire except to make money and with the expectation of going back to their native land to spend it. Eager to save, they lived wretchedly, disregarded the laws of health, took no steps towards becoming citizens of this country, and did not learn the English tongue. Fortunately, the majority of immigrants have had an ambition to become Americans and in most cases have become good citizens.

Beginning in 1882, the government has passed laws restricting immigration. Criminals, idiots, the insane, epileptics, those suffering from communicable diseases, anarchists, Asiatics, persons likely to become a public charge, and (since 1917) illiterates are excluded. Undesirable aliens may be deported after they have been admitted. After the World War the number of immigrants from each country was limited to a small percentage (three per cent in 1921) of the number of its citizens in the United States in 1910.

A New American—The Story of Mary Antin

A LITTLE girl with bright starry eyes stood at the rail of a great ocean steamer one glorious May morning and watched the shores of the promised land, America, creep nearer and nearer. She was 5,000 miles from her old home in far-away Russia but she was not afraid. Her mother, brother, and two sisters were with her on the ship, and on shore waited her father who had left home three years before to try his fortunes in the New World. And then was not this America, the wonderful land where no one was looked down on because he worked and where even the children of the poor could go to school?

Can you wonder that this little girl was excited when, after six weeks of travel through strange cities and across the ocean, she at last arrived at her new home? And what a strange home it was! After they had got safely by the immigration officers and joined their father, he took them in a rickety cab to the place he had rented in the slums of Boston. On the way he told them not to lean out of the windows and not to point at things, for if they did, people would know that they were "greenhorns" and not Americans.

AMERICANS IN THE MAKING

Here are young children of foreign-born parents, learning the speech and thought of the new home land in that great Americanizing agency, the public school. The eagerness of immigrants to have their children educated is proved by the fact that the percentage of illiteracy among children of foreign born parents is less than that among children of native birth.

Why Maryashe Changed Her Name

To be Americans was the one desire of the whole family. And one of the first things to do to realize this ambition was to take American names. Our little girl had been christened "Maryashe" at home and that would do very well shortened to "Mary." This was a bitter disappointment, for she did so want a strange-sounding American name like the others. For instance, her elder sister, Fetchke, came forth as Frieda and baby Deborah as Dora. But there was one consolation. Here she could use her surname all the time and not on state occasions alone. And so she felt very important to answer to such a dignified title as "Mary Antin."

With their old names the family exchanged their queer old home-made European dresses, which pointed them out as "greenhorns" to the children on the streets, for real American machine-made garments bought in a dazzlingly beautiful palace called a "department store."

The most wonderful thing happened on Mary's second day in her new home. A little girl from across the alley came and offered to take the children to school. Then it really was true that in America any child could get an education! There was no application to be made, no examinations to pass before you could enter, no fees to pay. But as school was almost over for the year their father decided that they had better wait until September to start. When September came their father took them himself. And Mary was no more eager to enter school than her father was to have her secure an education. In his excitement that morning he walked so fast that the children had to run to keep up with him. Finally they stood around the teacher's desk, and Mary's father in a few broken words explained his hopes for his children.

Although Mary was 12 years old she had to start in the first grade, for she knew no English and had never been to school before. But she was so anxious to learn that she advanced rapidly. Only one thing bothered her. That was the little word "the." She had a hard struggle not to say "zee." But she made her tongue stop buzzing when it said "the" and within a week she was advanced to the second grade. Oh, how proud Mary was four months later when her teacher showed her a paper with her name "Mary Antin" printed in it. For the teacher had sent something Mary wrote to a paper that had printed it. And even a little girl born in America might have been proud to write so well.

"Dingy? It's Beautiful!" Thought Mary

All this time Mary was being made into an American. Dingy little Chelsea, where her family now lived, was beautiful to her. The sight of the letter-carrier or the fire-engine made her happy and proud for they were part of her America. But she was happiest when in her second year in school—she was now in the sixth grade—the class began to study the life of Washington. The reader, the arithmetic, the song book, that had been so fascinating before, suddenly became dull books after she found the story of this great man. When she read the story of the cherry tree and of how the boy Washington would not tell a lie to save himself from punishment, she resolved that she would follow his example. But even if she never, never told a lie she could not compare with George Washington. He was brave, and she was afraid to go out when the snow-balls whizzed. And she could never be the First President of the United States.

There was one cheering thought in all this. Though she never could be as great as George Washington, she was, as one of her books said, a "fellow-citizen." Her father explained to her how he had become a citizen by naturalization and how, because she was his little daughter, she was also a citizen. This was rather a sobering thought. "If I am a Fellow-Citizen," she thought, "then I must act as a Fellow-Citizen should."

When her class stood up to sing 'America' Mary shouted with all her might, and she meant every word of it when she sang:

I love thy rocks and rills,
Thy woods and templed hills!

As they began to prepare a program for Washington's birthday, Mary decided to write a poem. It was hard work, for poetry, you know, is not always easy to write, and Mary frequently had to pick the words she wanted out of the dictionary. Perhaps it wasn't very good poetry, for Mary herself long afterward laughed at it. But when you think that a little girl 13 years old, who had not been in school two years, wrote it, and that it expressed her love for her new home and for its history, it is wonderful. Here are two of the stanzas of it:

He whose courage, will, amazing bravery,
  Did free his land from a despot's rule,
From man's greatest evil, almost slavery,
  And all that's taught in tyranny's school,
Who gave his land its liberty,
  Who was he?

'Twas he who e'er will be our pride,
  Immortal Washington,
Who always did in truth confide,
  We hail our Washington.

Mary read her poem in her own room at school and then was sent to other rooms to read it. Everyone thought it wonderful that a little girl who had been an American for so short a time could do so well. Somebody suggested that it should be printed and so Mary, without saying a word to her father and mother, took it to a newspaper office. At the first office no one would pay any attention to her. But at the second she had better luck. The editor promised to print it and send her a copy of the paper with it in. He asked her many questions about herself. By and by the paper came.

You can imagine how happy Mary was. And her family were as proud of her as they could be. Her father bought all the papers he could find and gave them to friends. They were all sure that some day Mary would be great. Because of this belief they kept Mary in school.

This was not easy because the family were very poor. Sometimes they had nothing in the house to eat. They moved from one tenement to another in search of a cheaper place, and many times angry landlords threatened to turn them into the street because they could not pay the rent.

Mary helped all she could on Saturdays and in the evenings, but she could not do much for she was not very strong. But while she was going to school, or reading in the library, she was really getting ready to help her family. And finally the day came when she not only could help them live better but also by her book 'The Promised Land', helped other new Americans by telling the story of how she was made into an American.

IMMORTELLE. This odd plant of the composite family owes its name, which means "everlasting," to the fact that its flowers do not change in color or appearance in drying. Although a native of North Africa, Crete, and Asia, it seems rather to belong to southern France, for there, on the ground sloping down to the Mediterranean, it is cultivated in great quantities. It requires light, sandy soil, and is planted in plots surrounded by dry stone walls in positions well exposed to the sun. The flowers, which have dry, scaly, deep yellow bracts, are gathered in June when these bracts are fully developed. All fully expanded and immature blossoms are pulled off and rejected, for to retain their appearance when dried, they must be in just the proper condition. The dried immortelles are woven into wreaths and garlands, to be placed beside graves as emblems of immortality. They are also dyed black, red, or green and used for bouquets and other ornamental purposes. The scientific name of this flower is *Helichrysum orientale.*

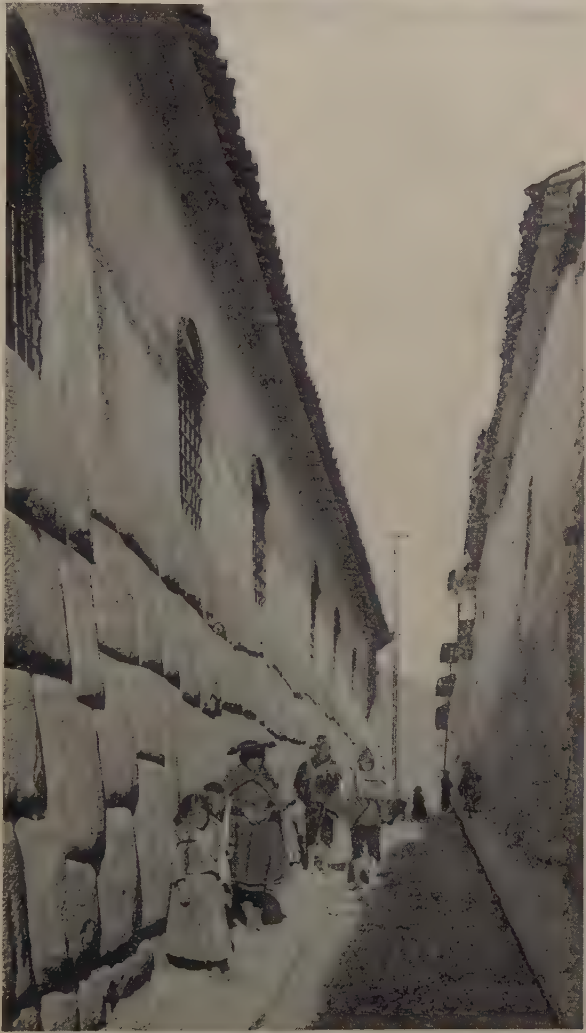
The name immortelle is also given to several other plants with dry scaly blossoms. Among them is an Australian plant (*Helichrysum bracteatum*) which has single and double flowers of different colors; and one of the Cape of Good Hope (*Helichrysum vestitum*) which has white satiny heads. The most common American varieties are several species of the cudweed (*Gnaphalium* and *Antennaria*).

IMPEACHMENT. When the framers of the United States Constitution were seeking some means to control men in public office, without depriving them of a reasonable independence, they took over the process of impeachment from the English. The president, vice-president, judges, and all civil officers of the United States are subject to impeachment for causes, which are named in the Constitution as "treason, bribery, or other high crimes and misdemeanors." The House of Representatives by majority vote makes the accusation. The Senate, sitting as a court of impeachment, is the judge of the officer's guilt. Its action is judicial, not legislative, and from its decision there is no appeal. The penalty in case of conviction is simply removal from office and disqualification for further public service. A number of impeachment cases have come before the Senate, one of them that of a president—Andrew Johnson—who was acquitted.

Impeachment is provided for in the constitutions of most of the states also. It has been superseded to some extent by the "recall," which in some states allows the voters to vacate any office before the expiration of the officeholder's term.

IN'CAS. Scattered over the central highlands of the Andes Mountains of South America are found the remains of massive stone temples, palaces, fortresses, terraces, and dwellings, with pottery, textiles, and gold ornaments. These are the only traces so far discovered of the ancient civilization of the mysterious Incas, a race of Peruvian Indians that held sway for 1,200 miles from what is now Chile, north through Peru and Bolivia into Ecuador.

IN THE ANCIENT CAPITAL OF THE INCAS



The walls of many of the houses in Cuzco, Peru, capital of the ancient empire of the Incas, are extensions of the remains of the old Inca walls. The stones in the lower half of the buildings in this picture were set by Inca masons, perhaps before Columbus discovered America. The strength of these massive walls testifies to the high skill of the old Indian architects.

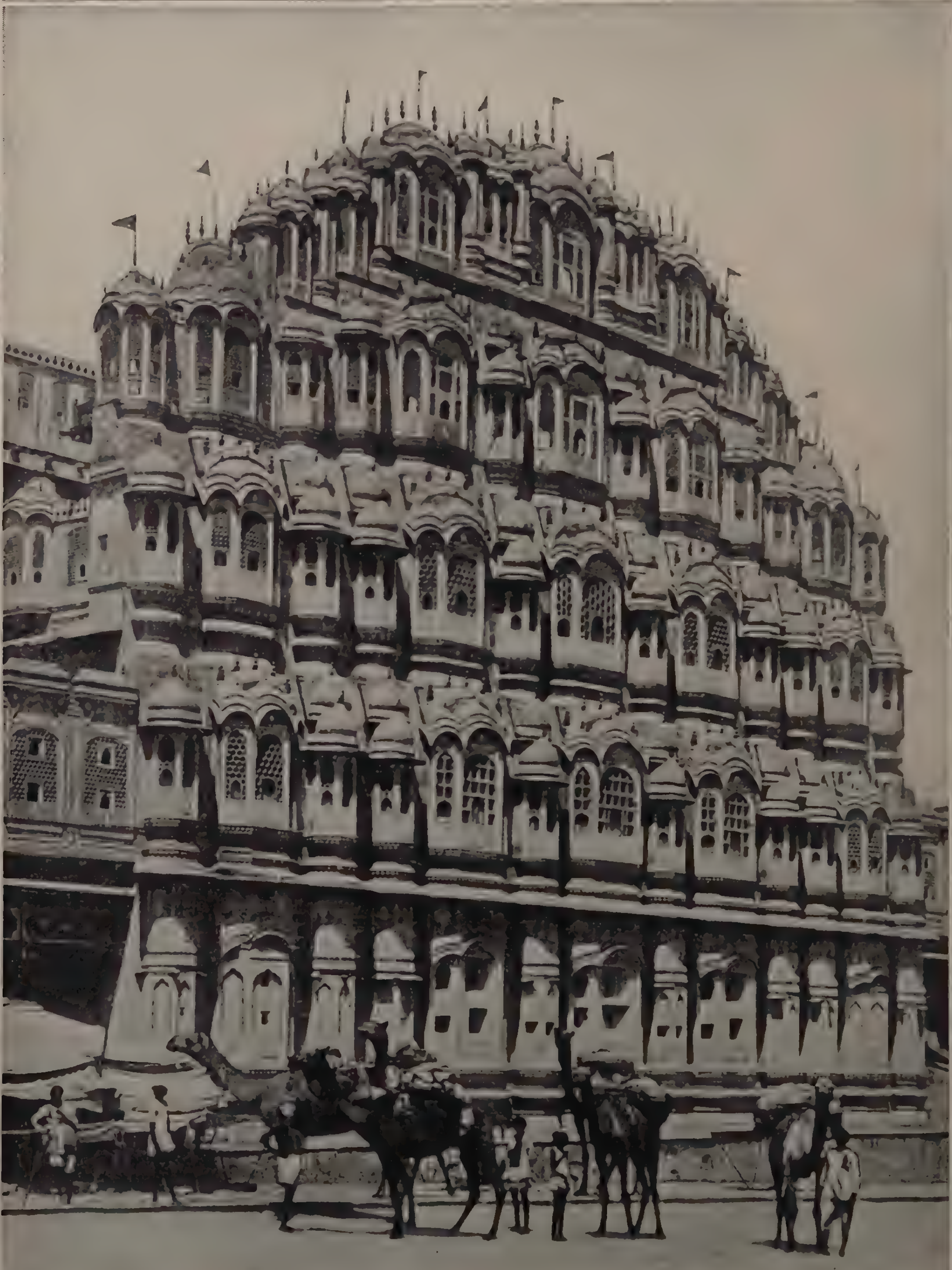
Whether the Incas stood just at the beginnings of civilization, or whether, as some believe, they represent a culture as old as that of Egypt and more advanced than that of their Spanish conquerors, is still disputed. But they certainly left some remarkable monuments. Above the city of Cuzco in Peru, their ancient capital, tower stupendous ramparts made of individual stones of prodigious size. No mortar was used, yet after centuries these stones lie so cunningly fitted to each other that it is impossible to insert the blade of a knife between them. Some are 20 feet high and weigh many tons. Ruins like these occur in many parts of the Andes, together with remains of stone causeways and carefully terraced fields, all telling of a strong and highly gifted race. Rude records were kept by means of a system of variously knotted and colored cords (called *quipu*), but the Incas were ignorant of writing. Later accounts, of doubtful reliability, ascribe to them a remarkable social organization, in which the land was allotted by the state in small holdings, irrigation was extensively practiced, and poverty was unknown. The ancient population was said to be between 8,000,000 and 12,000,000.

The Incas were skilful weavers, and seem to have been proficient in every style of hand weaving we know today. They also knew how to smelt metals and cast in molds; and in the making of pottery they were artists. Evidently, also, they had made some progress in music, for among the remains of their civilization are found flutes made of bone and of cane, clay trumpets and trumpets of shells, bells of different tones, some made of bronze, some of pure copper. They built paved roads, with suspension bridges and post-houses at intervals over the wildest mountain ranges and through the desert for hundreds of miles.

The fall of this thriving and industrious race before Pizarro and his handful of Spaniards forms one of the tragedies of history. The spirit of the race was broken and after a few disastrous rebellions it fell into the submissive apathy which marks the Peruvian Indians of today. Slaughter and oppression, continued through centuries, thinned their numbers until the pure-blooded descendants of the Incas are estimated now to be fewer than 3,000,000. (*See* Peru; Pizarro.)

INCOME TAX. A direct tax greatly used in modern countries, including the United States, as a means for defraying the increasing expenses of government with least hardship to individuals. Usually incomes below a certain amount are exempt and the rate of taxation increases with the amount of income. The income tax became a permanent part of the British fiscal system as early as 1853. In the United States, however, this tax was not adopted until 1913, after an amendment to the constitution had been passed, permitting such a tax to be imposed. (*See* Taxation.)

THE DREAM-LIKE "HALL OF THE WINDS"



The Hall of the Winds at Jaipur, India, Sir Edwin Arnold called a "vision of daring and dainty loveliness"; and he goes on to speak of it as "nine stories of rosy masonry [it is finished in pink and white stucco] and delicate overhanging balconies and latticed windows, through the thousand pierced screens and gilded arches of which the Indian air blows cool over the flat roofs of the very highest houses in Jaipur."

The TEEMING MILLIONS of BRITAIN'S INDIAN EMPIRE

This picture takes you into the very heart of the story of India. It presents two of the most important aspects of that mysterious land—its crowded population and the powerful influence of its ancient religions. For here we see a dense throng of pilgrims bathing in the Ganges River near the city of Benares. From all parts of India they have come to wash away their sins in the "sacred waters." Back they will go, probably scattering broadcast the germs of plague and cholera. Before the conservatism of the East, Western civilization still stands almost helpless, unable to penetrate the ranks of this vast army of people, unable to teach them the laws of health or sway them from their age-old customs.

Extent.—North to south, 1,900 miles; east to west, 2,000 miles. Area, about 1,800,000 square miles. Population, about 315,000,000.

Physical Features.—Himalaya Mountains, the highest in the world (20,000 to 29,000 feet); Vindhya Range and Eastern and Western Ghats, inclosing the Deccan plateau; deserts in Sind and Rajputana. Principal rivers: Indus, Ganges, and Brahmaputra.

Products.—Millet, rice, wheat, barley, oil-seeds, cotton, jute, sugar, indigo, coconuts, tobacco. tea, and opium; cotton and silk manufactures, metal work; coal, gold, and petroleum.

Chief Cities.—Calcutta (1,225,000 population), Bombay (980,000), Madras (520,000), Hyderabad (500,000), and Delhi, the capital (235,000).

History.—Aryan invasion, about 1500 B.C.; rise of Buddhism, 6th century B.C.; Alexander the Great's conquest of the northwest, 327 B.C.; Mohammedan conquest, 1001 A.D.; establishment of Mogul Empire, 1526; English East India Company obtained trading posts at Madras (1639), Bombay (1668), and Calcutta (1696); Battle of Plassey established British supremacy over the French, 1757; expansion of British India, 1774–1856; Indian Mutiny, 1857; British Crown takes over government from East India Company, 1858.

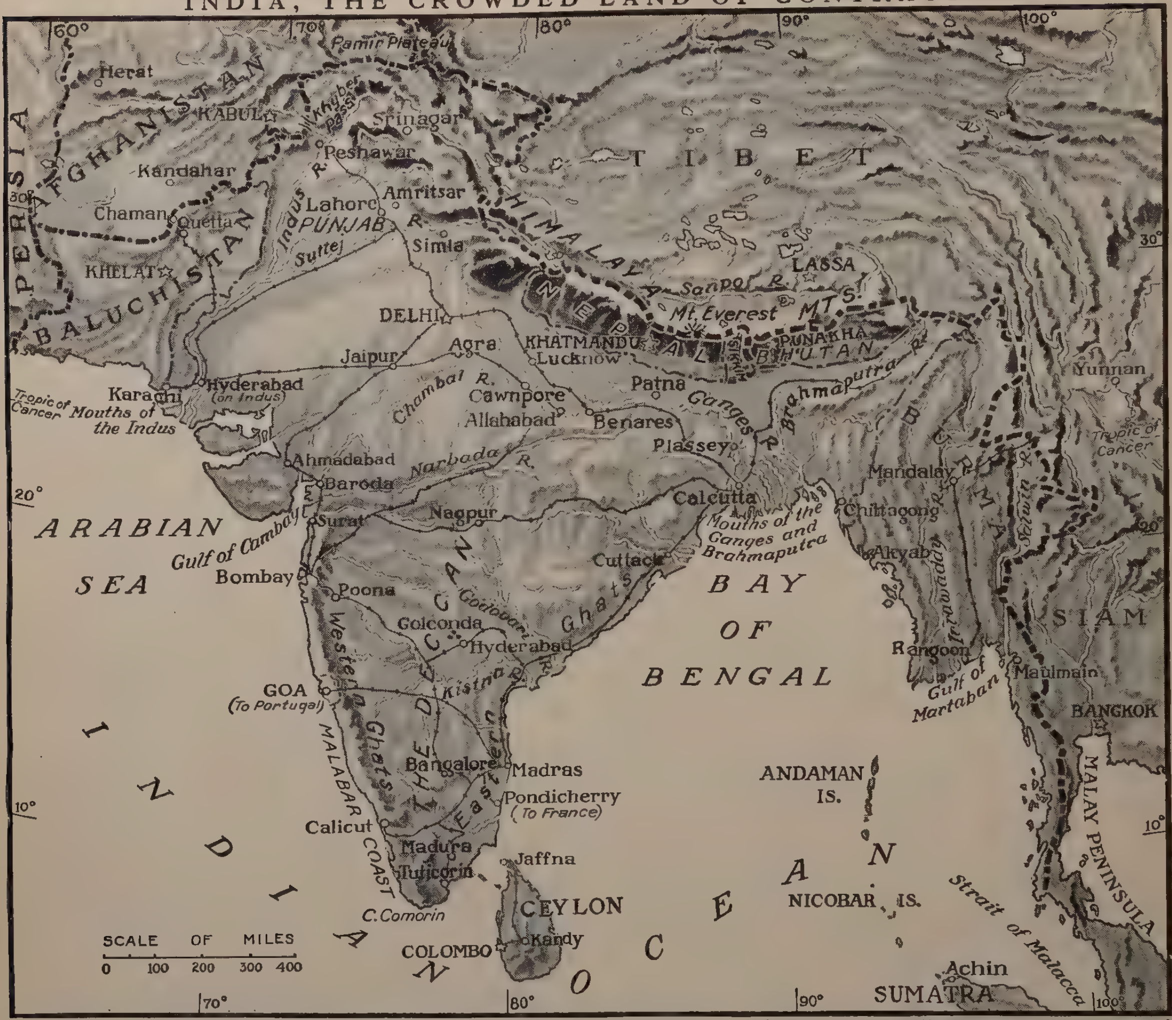
INDIA. A land of fascinating and infinite variety is India, which thrusts 1,900 miles downward from the Himalaya Mountains into the Indian Ocean and is inhabited by almost one-fifth of the human race. And what contrasts among these crowded people! They are divided into numerous races and clans; they speak more than 100 distinct languages and dialects; they profess countless shades of religious beliefs; they are split into more than 2,000 social castes; and they are grouped into more than 700 provinces and petty states. Despite their civilization reaching back 5,000 years, more than 90 per cent of these people cannot read or write in any language. Some of the more powerful Indian princes, with their secret stores of gold and silver and precious stones, are among the most wealthy men in the world; yet the average per capita income of the people is about $20 a year. Unbelievable poverty reigns for the most part. Thousands die of starvation almost every year, and thousands more, weakened by hunger, fall victims to the plague.

The land itself presents almost as many contrasts as the people. In the north the granite peaks of the Himalayas, the highest mountains in the world, are cloaked in eternal snows (*see* Himalaya Mountains), while in the extreme south Cape Comorin dips its coral-studded foot into warm tropical waters. Between these two extremes are found cool hill regions as well as suffocating jungle lands; barren deserts and also river valleys of unsurpassed fertility.

The Divisions of India

A broad view of the country shows four separate and well-defined regions. The mountain and hill districts of the Himalayan ranges, and the slopes of the Afghanistan and Baluchistan highlands form the northern and northwestern borders. Then come the great river plains of the Indus, the Ganges, and the lower Brahmaputra, forming a broad belt from the head of the Arabian Sea to the head of the

INDIA, THE CROWDED LAND OF CONTRASTS



India, a land of contrasts in people and topography, is here spread out before us. It is shut off from Tibet by the famous "Roof of the World," the Himalayas, with their eternal snows. To the north and west are the slopes of the highlands of Afghanistan and Baluchistan. Then come the great river plains; next the vast tableland known as the Deccan with the giant stepping stones, the Ghats, sloping down to the eastern and western coasts.

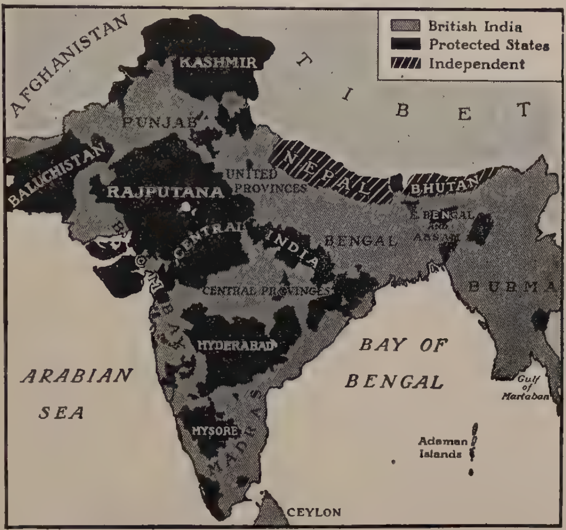
Bay of Bengal. Next is the great tableland known as the Deccan, which begins where the Vindhya Mountains and their connecting ranges rise from the Ganges plain and includes the southern half of India; it is bounded by the range of hills known as the Eastern Ghats (literally, "stepping stones") sloping down to the Coromandel Coast, and by the Western Ghats descending to the famous Malabar Coast. On the other side of the Bay of Bengal, but politically a part of India, is Burma, a wild and hilly region south of the Brahmaputra valley and extending far down along the west side of the Malay Peninsula, skirting the possessions of Siam (*see* Burma).

The northernmost portion of India, and one of the most important of the native states is Cashmere (Kashmir), which extends over the first Himalayan ranges, and includes the famous Vale of Cashmere (*see* Cashmere). Beyond the Indus, between Cashmere and Afghanistan, stretches the Northwest Frontier Province—a wild rocky region, which forms a buffer between peaceful India and the untamed Afghan tribes. Here is the approach to the famous Khyber Pass, scene of many bloody encounters. The capital, Peshawar, is an important military post as well as a railway terminus and caravan trading station. Even more wild and unsettled is Baluchistan, immediately to the south, which borders on Persia as well as Afghanistan. Only the northern part, about Quetta and the Bolan Pass, is under direct British rule. Nepal and Bhutan, on the borders of Tibet, are independent mountain states with foreign relations subject to British control. In Nepal is located the tallest mountain in the world, Mount Everest; and here too are the famous fighting men, the Gurkhas, who volunteer in large numbers for service in the British armies.

These mountain states and border districts form a picturesque background for the far more important river plains which make up the second division of the country. Broadly speaking, the plains region extends from the delta of the Indus northeastward to the Himalayan foothills, and down the Ganges valley to the Bay of Bengal. Here is a tract of level cultivation about 2,000 miles long and from 200 to 400 miles broad, without a stone of any kind, scarcely a pebble. The soil is composed of river sand and silt, washed down through countless ages from the slopes of the mountain walls to the north.

The Indus at the west and the Brahmaputra at the east have their sources in Tibet behind the snow peaks of the Himalayas, at no great distance apart; and curving around in opposite directions include in their embrace not only the main Himalayan mountain chain but all that portion of northern India which is properly known as Hindustan. This country, in turn saturated by warm rain, chilled by light frosts and scorched by desert winds, is the cradle of ancient Indian civilization. The Ganges valley is one of the most crowded regions in the world, many extensive districts supporting more than 600 persons to the square mile, all of whom get their living directly from the soil. By way of contrast, Baluchistan has only about six persons to the square mile.

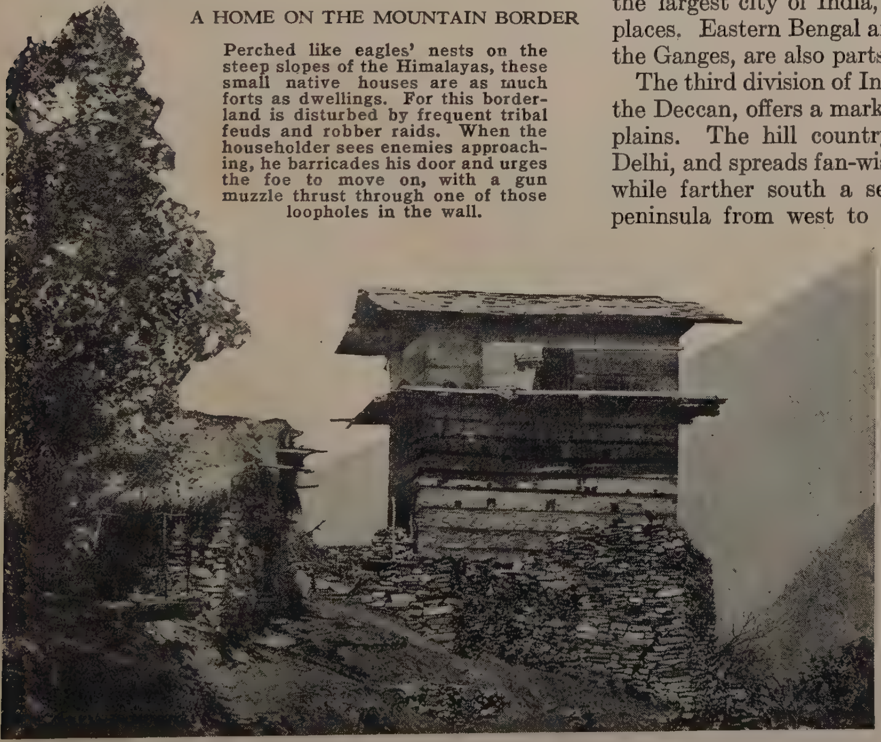
THE POLITICAL PATCHWORK OF INDIA



This map shows how India is divided politically. The regions shown in gray constitute British India proper, where British law holds complete sway. The black portions are the so-called "Native States," where the control of internal affairs is left to a great extent in the hands of hereditary native princes. The states of Nepal and Bhutan are completely independent, save in foreign relations.

In this rich plains region are the Punjab or "Land of the Five Rivers," with the important cities of Lahore, Amritsar, Simla, and Delhi, the capital of all India; Rajputana, a collection of about a score of small native states, with the cities Jaipur, Jodhpur, and Bikanir; the United Provinces of Agra and Oudh, with the famous cities of Allahabad, Cawnpore, Lucknow, Benares the "Holy," Agra, Bareilly, and Meerut; and the Bengal district with Calcutta, the largest city of India, and Patna as the principal places. Eastern Bengal and Assam, which lie beyond the Ganges, are also parts of this division.

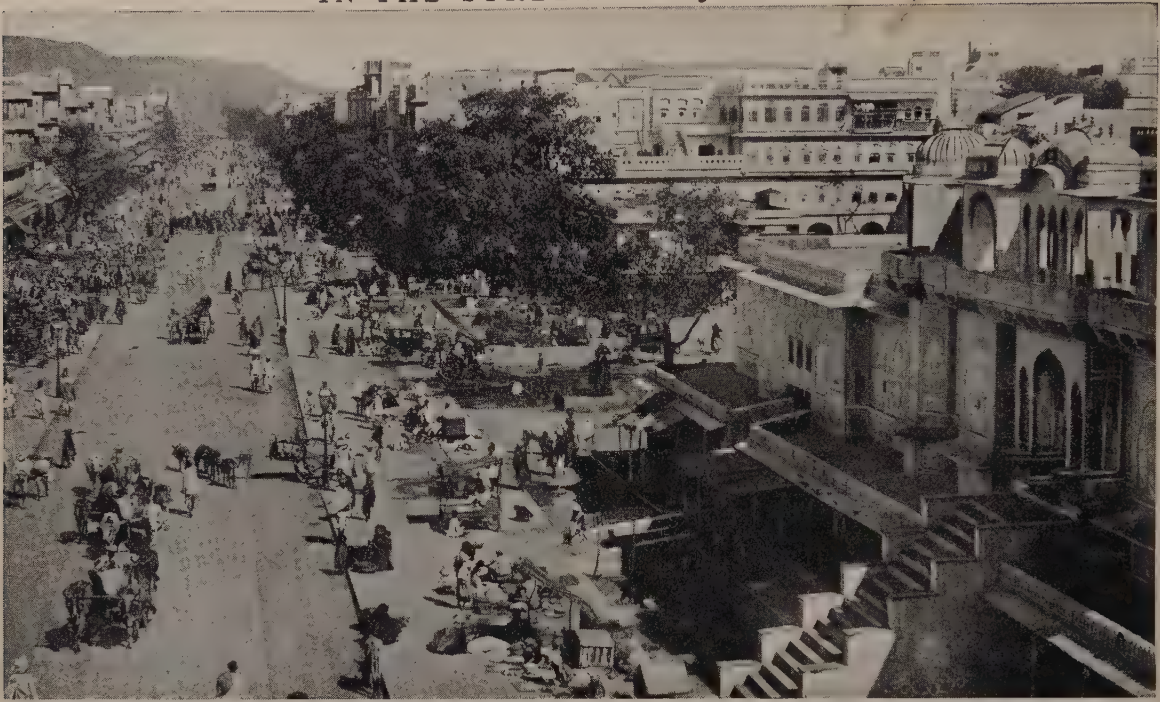
The third division of India, the peninsula known as the Deccan, offers a marked contrast to the northern plains. The hill country begins not far south of Delhi, and spreads fan-wise southeast and southwest; while farther south a series of ranges crosses the peninsula from west to east. The Western Ghats follow the coast closely rising in an unbroken wall to an altitude of 8,000 feet behind the old Portuguese port of Calicut. Close to the coast as they are, the Western Ghats form the true backbone of India, for from their rugged sides the whole country slopes generally eastward; the rivers which rise in their narrow landward gorges flow for the most part clear across the peninsula and empty into the Bay of Bengal. The Eastern Ghats are of no great



A HOME ON THE MOUNTAIN BORDER

Perched like eagles' nests on the steep slopes of the Himalayas, these small native houses are as much forts as dwellings. For this borderland is disturbed by frequent tribal feuds and robber raids. When the householder sees enemies approaching, he barricades his door and urges the foe to move on, with a gun muzzle thrust through one of those loopholes in the wall.

IN THE STREETS OF JAIPUR



Isn't this a fine broad street? We are in the city of Jaipur. With its palaces and houses of pink stucco built in delicate ornamented patterns, it suggests a pictured city on the drop curtain of a stage. It is really a busy, prosperous town and quite young, as time goes in ancient India, Jaipur having been founded in 1728 by the Maharaja Jai Singh II. It is the only city in India that is laid out in straight streets and rectangular blocks.

altitude; they average less than 1,000 feet and are broken through in many places by rivers large and small, which cut deep gashes to the sea.

The central Deccan consists principally of rough hills, some covered with dense forests, others with tall jungle grass, and still others swept bare by dry winds. At intervals are broad well-cultivated plateaus, and the banks of the numerous streams are dotted with tiny irrigated farms and cleared pasture lands.

The political divisions of southern India are more confused than are those to the north. The Bombay presidency includes the Sind region and more than 350 small native states. Its chief city is Bombay, the second largest in India. East of the Bombay Presidency lie the native states of the Central India Agency and the Central Provinces under direct British rule. The cities of Gwalior in the north and Nagpur in the south are the most important. Farther south and occupying the very heart of the Deccan are the dominions of the Nizam of Hyderabad, the largest and most populous of the native states.

The Madras Presidency, the largest of the British provinces, begins south of the Bengal district, includes the whole east coast to Cape Comorin, and extends to the west coast, almost completely surrounding the large native state of Mysore (capital, Bangalore), and crowding the states of Cochin and Travancore into the southwest corner. This region, especially the Carnatic, is rich in historic traditions. The city of Madras is the third largest in India; other important places are Madura, Trichinopoly, Calicut, Mysore, Negapatam, and Cuddalore.

"ON HIS MAJESTY'S SERVICE"

Camel riders like this form an important branch of the military service of India. Notice that this man though wearing a uniform wears the native headgear, as do all the native Indian troops.

The Winds of Life

Picture to yourself a typical Indian scene during the months of April and May. The burning and pitiless sun looks down upon a land sapped of its strength. The baked earth seems dead, the dried grass rustles with the scorching breath of the wind; the very blue of the sky seems to turn brassy in the intolerable white light of noon. Doors and windows are closed to shut out the furnace blasts, and the population dozes and gasps for air. Birds with beaks open and drooping heads seek such shade as they can find. Gaunt cattle gather under the trees. A deathly silence reigns.

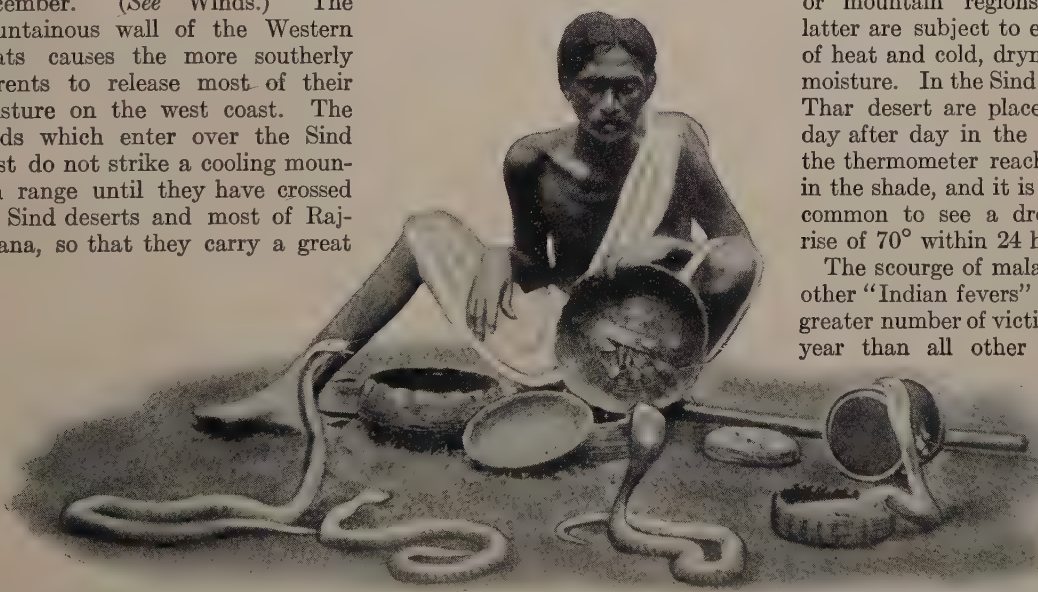
LIKE A BIRD IN A CAGE

While wealthy Indian princesses travel in jeweled palanquins, veiled with silken curtains, the poor uphold their ideas of propriety with such crude affairs as this. The young lady here could probably travel much faster on her feet, but that would be a social "faux pas."

Presently a dust-storm advances. Behind this rise great black clouds, rolling forward like a tidal wave. The storm bursts overhead with a roar and the water strikes the ground in sheets. The great *monsoon* has come, the annual southwest wind which brings life-giving rains to northern India. Within a week the bleak country has become again a mass of green.

The monsoons are the salvation of the millions in India who live on the fruits of the soil. There are two of these winds, the "great" or *southwest* monsoon, which blows from June to October; and the "lesser" or *northeast* monsoon, which blows during November and December. (*See* Winds.) The mountainous wall of the Western Ghats causes the more southerly currents to release most of their moisture on the west coast. The winds which enter over the Sind coast do not strike a cooling mountain range until they have crossed the Sind deserts and most of Rajputana, so that they carry a great part of their moisture far into the Punjab, or sweep eastward along the Himalayan barrier, shedding their rain through the United Provinces and Bengal. In eastern Bengal these winds meet the monsoon coming up the Bay of Bengal, and the two together sweep onward until they strike the Assam hills, where they drop their double charge of moisture. This explains why Assam has the largest rainfall of any region on earth, 50 or 60 feet a year being not unusual in the Cherra Punji district (50 *inches* is above the average in the United States).

WHAT IF THE CHARM SHOULD FAIL?



Four deadly cobras have crawled out of their baskets, as the Indian Snake Charmer hums his low rhythmic song. Three of them have reared their heads, expanding their "hoods" while they sway in time to the music. The secret of the "charm" is not thoroughly understood, but it is believed to be a form of hypnotism. Sometimes it fails and the Snake Charmer is bitten and dies.

As the land cools under the influence of the rains, the *southwest* monsoon blows itself out in October, and in November the *northeast* monsoon sets in. This carries rain to the east and southeast and to the central plateau of the Deccan, which, as we have seen, are deprived of their due share of the earlier moisture by the barrier of the Western Ghats. A good monsoon season means plenty of food for India, a bad monsoon season means starvation, misery, and death for thousands of helpless victims.

In general southern India enjoys a more equable climate than the river plains or mountain regions. The latter are subject to extremes of heat and cold, dryness and moisture. In the Sind and the Thar desert are places where day after day in the summer the thermometer reaches 110° in the shade, and it is not uncommon to see a drop or a rise of 70° within 24 hours.

The scourge of malaria and other "Indian fevers" claim a greater number of victims each year than all other causes, including even cholera and plague. Europeans during the hottest weather usually seek the high altitudes of Simla, Cashmere, and elsewhere.

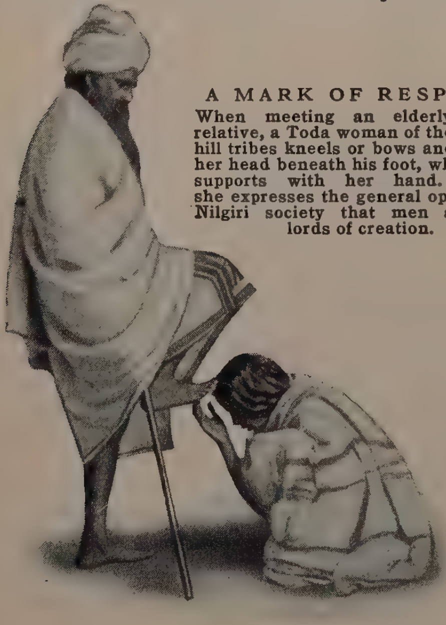
The Himalayan climate is favorable to a tremendous variety of plant life. Below the snow line are found vast fields of rhododendrons, then thick forests of evergreens, and on the damp lower slopes to the east a rank and tangled undergrowth of coarse grass, bushes, canebrakes, bamboo, and great trees, whose branches are thick with orchids. The plains region is notable for the *babul*, a species of acacia, the mango, the banyan, the plantain, and the betel-palm. The northern Deccan forests consist chiefly of scrub trees, but in the south teak, sandalwood, and satinwood flourish abundantly.

Wild animals abound all over India, for religion forbids the majority of the people to kill any living creature. The tiger is found in all the wilder forest regions, and is responsible for about 500 deaths a year throughout the empire. Lions, once plentiful in Hindustan, are now confined to the Kathiawar peninsula between the Gulf of Cutch and the Gulf of Cambay. Bears are numerous in the mountains and leopards infest many of the more remote tracts. Elephants still exist in the primeval forests of the southwest, but the ranks of the domestic elephants are mainly recruited in the hills of Assam and Burma, where dwells also the rhinoceros. The *gaur* or Indian bison, the wild buffalo, and the wild pig offer exciting sport to the hunter in many parts of the land. The wolf, the jackal, the wild dog or *dhole*, and the striped hyena are plentiful. Monkeys are numerous near settlements and do great damage to crops. The larger rivers are filled with crocodiles; and snakes abound in all districts, the cobra and the krait being the most dangerous and causing thousands of deaths annually. Insects are incredibly numerous. A few, such as the bee, the silkworm, and the lac-insect, are useful, but by far the greater number are exceedingly harmful or annoying pests.

THE UNTAMED AFGHANS

These two chiefs belong to the border tribes of Afghanistan. These tribes are composed for the most part of haughty and fierce barbarians, ever ready to fight for their independence or simply to "fight for fun."

A MARK OF RESPECT



When meeting an elderly male relative, a Toda woman of the Nilgiri hill tribes kneels or bows and places her head beneath his foot, which she supports with her hand. Thus she expresses the general opinion of Nilgiri society that men are the lords of creation.

The population of India may be roughly placed in five groups: (1) The descendants of the earliest known inhabitants of India, sometimes called Dravidians, who are represented by the savage Bhils and Gonds of central and western India, and by the Tamils of the south. (2) The pure-blood descendants of the successive tides of Aryan invaders who came in through the northwestern passes and conquered the Dravidian inhabitants, and who are best represented by the Rajputs. (3) The great mass of Hindus formed by a mixture of the two preceding types. (4) The descendants of the Mohammedan invaders who began pouring in in the 7th century. (5) The Mongol or Tibetan types, which are found chiefly in the extreme northeast and in the Himalayan border regions.

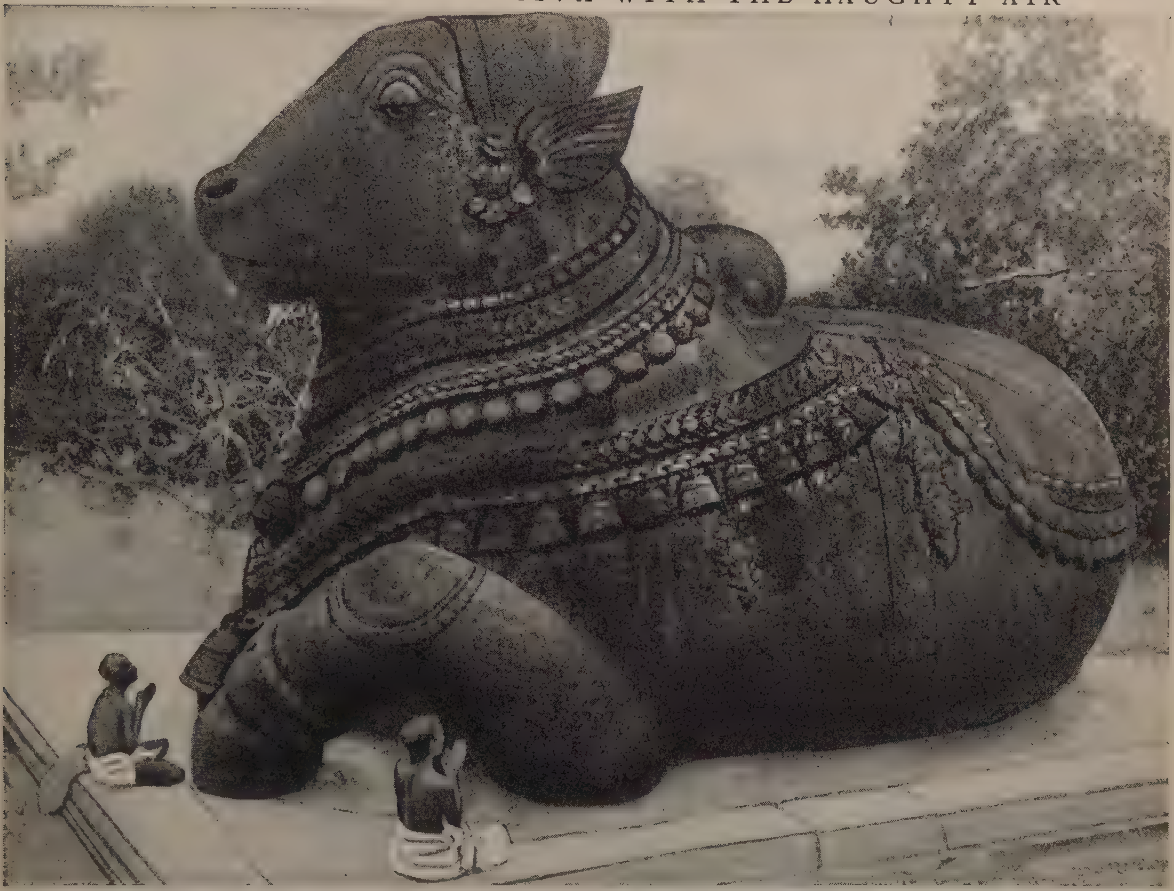
The people of Dravidian stock are short, dark, with curly or wavy hair and broad noses. At the other extreme are the Rajputs, tall, slender, and handsome. Most Hindus range between these two types.

The many separate languages of India can be generally divided into those derived from the ancient Sanskrit and those from the early Dravidian tongues, with a mixture of Malay and Chinese elements. In northern India the interstate and intertribal dialect is Hindustani or Urdu, a blend of Persian with the dominant "Hindi" language.

But it is not so much linguistic or racial differences which divide the people of India as differences of religion. The chief of these are Hindu, Mohammedan, Buddhist, Sikh, Jain, Christian, and Parsee.

Next to the crude animistic beliefs of the primitive hill peoples, who see gods in rocks and trees, Hinduism is the oldest religion, and includes in its numerous sects more than 200 million persons. Hinduism has many forms, all marked by a belief in many gods, in

THE GIANT BULL OF SIVA WITH THE HAUGHTY AIR



This immense figure carved from stone stands near the city of Mysore. See that look of calm disdain on his face, while the two Hindus kneel before him in prayer! That's because he is a representative of the god Siva, and because under that great left hoof rests the fate of many a poor worshiper, or at least so they believe.

universal reincarnation, and by accepting the supremacy of the Brahmans and the restrictions of the caste system (*see* Hinduism). The Sikhs form a religious community, centering in the Punjab, whose history dates back to the 16th century. Their faith is a curious mixture of Mohammedanism and Hinduism, and for a time they constituted a military brotherhood of formidable power. Today they number little more than three millions. The Jains, on the other hand, tend to combine the Buddhist and Hindu religions. There are today about 1,250,000 Jains, scattered through Hindustan and westward in Gujarat, and among them are many of the richest and most influential of Indian merchants. Their temples, among which are the famous ones on Mount Abu, are the finest in all India. The Parsees are descendants of Persian Zoroastrians—fire and sun worshipers who fled to India to escape the Mohammedan massacres of the 7th century. Centering about Bombay, they form now a rich merchant class of great power, despite the fact that their total number is only 100,000.

The native Christians of India total about four millions, with the Roman Catholics far in the lead. The Mohammedans, with about 65 millions, form the largest religious group next to the followers of Hinduism (*see* Mohammed). The Buddhists, once exceedingly powerful in the land, have virtually disappeared from India proper; of the 10,000,000 counted in the empire today, all but about 100,000 are found in Burma (*see* Buddha).

THE STONE BULL'S LIVING BROTHER

Indian cattle are peculiar for the fleshy hump on their backs and the great fold of skin under their necks. While very humble looking, compared to Siva's stone bull above, they nevertheless receive a big share of Hindu reverence.

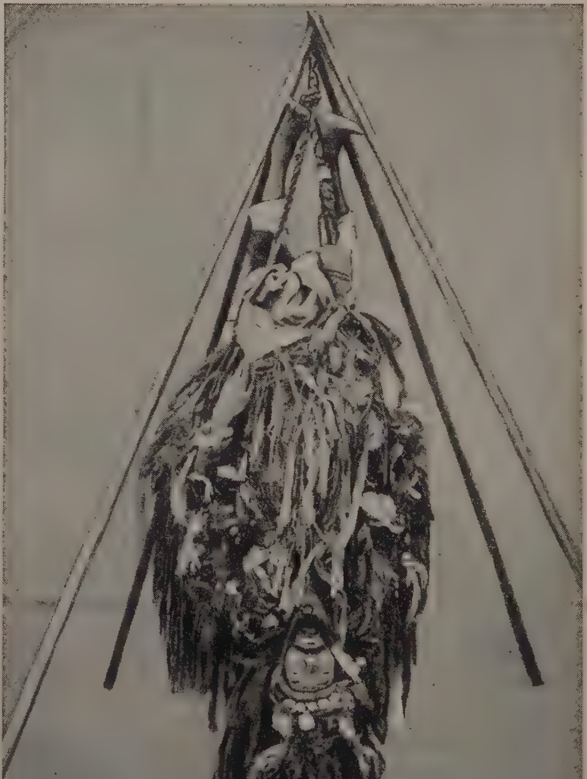
A CURIOUS WAY TO CURE THE TOOTHACHE

If you were a native boy of India and got the toothache, your parents might first call a native doctor; then, if you didn't get better, a soothsayer, who would call in the devil dancers, and the devil dancers would bring with them the tom-tom players, such as those in the picture, to beat time while they propitiated the "Toothache Devil." The dancers would first put on masks representing the way one looks when he has the toothache and later masks showing the face of a mild inoffensive person, to represent the Toothache Devil in a good humor; as much as to say to him in sign language, "We know you are causing this trouble, but after all you are a decent fellow, and kindly don't hurt this little boy any more." Curiously enough these ceremonies usually have a favorable effect on the patient—just because he thinks they will, no doubt.

The followers of Hinduism, which means at least two-thirds of the population, are grouped into countless castes which are half social, half religious. The caste system had its foundation in the old Aryan law, which divided the people into four classes — the priests or Brahmans, the warriors or Kshatriyas, the farmers or Vaisyas, and the laborers or Sudras. The latter consisted of the conquered non-Aryan peoples.

Today these four original castes have been subdivided again and again until it is impossible to tell the number. Estimates vary between 2,000 and 3,000 distinct groups. The divisions are made upon a basis of race, geographical situation, and occupation. Thus five classes or "nations" of Brahmans dwell south of the Vindhya Mountains and five to the north; and these ten are in turn split in no less than 1,886 tribes.

AN UPTURNED SAINT



Dressed in rags and suspending themselves like this for long periods of time, the "Saints with the Upturned Face" get a great reputation for sanctity. They are only one of the many classes of "fakirs" or holy men among the Hindus who inflict painful penances upon themselves.

The members of each handicraft, such as potters, jewelers, etc., tend to form separate castes which amount to trade gilds or unions.

The restrictions which surround members of a caste are innumerable. Generally speaking a person may not marry outside his caste, nor may he touch or associate with a member of a lower caste. Certain of the high-caste Hindus feel that they are profaned if even the shadow of a European or of the member of a lower caste falls upon them or their food or anything which belongs to them, and that they must thereupon perform elaborate rites of purification.

Lower yet than the Sudras are the Pariahs or outcasts — a mass of 53,000,000 people, one-sixth of all the population of India. These "untouchables" are prohibited the use of public roads, bridges, and temples. They are forced to live outside the villages and are allowed to enter only such despised occupations as street-sweeping and leather-working. So defiling is their touch that most Hindus would rather die than accept their help, and they are not even allowed to draw water from the public well.

WHERE DANCING IS A RELIGION

This is one of the "Nautch" dancers connected with the temples in India, who are known as servants of the gods, because they dance and sing before the idols. They also dance at banquets, marriages, and public entertainments. Notice the jewel the girl wears in her right nostril.

The average Hindu is a peaceful, patient person. "Life in India," says one writer, "is regarded in a very serious spirit by which even the children are subdued. You will never see them romping at play, and their games are of the quietest description. They take no pleasure whatever in teasing animals, and the birds and beasts of the household are extraordinarily tame. They are not so much petted as treated with the consideration due to members of the family; the cultivator appeals to his bullocks as 'my brothers.' To adults life offers few pleasures. Eating is a monotonous experience of the plainest dishes. Drinking, for the respectable, is limited to water. There are no attractions in sport or in physical exercises. Fairs and festivals give some excitement to the women who can attend them; but the men derive their pleasure rather from the gratification of a sense of dignity and importance than from the exercise of the functions of mind or body."

The position of Indian women is not enviable. They are usually not permitted to learn to read and write, but are closely confined to their homes, where they perform all the menial tasks. They are not even permitted to sit down to meals with their husbands, but must serve them in silence and take what they leave. In spite of legislation, infant and child marriages are common. Although the practice of *suttee,* which allowed a Hindu widow to burn herself on the pyre of her husband, has been stamped out, the lot of a widow is pitiable. She must keep her head shaved, give away all her jewels, and usually spend the rest of her life performing the most menial labor for the family of the dead husband.

WATER CARRIERS

In many regions where water is scarce, it is carried from house to house in sheepskins and sold to the housewives. The water carriers form one of the lowest castes.

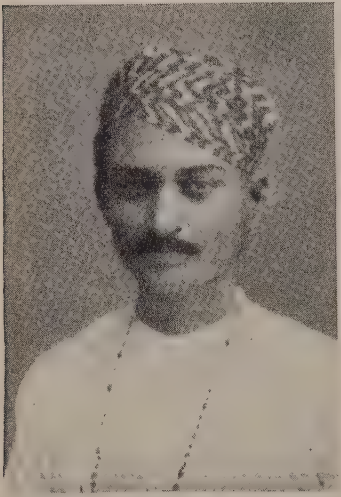
The caravans which slowly tread their way through the passes of Afghanistan are following one of the oldest trade routes in the world. At the dawn of history India was already famous for its wealth, its gold and silver and precious stones, its fine silks, its spices and drugs and rare woods. Treasures from India reached the ancient courts of Assyria and Egypt.

Today India's wealth is not reckoned in gold or precious stones, but in the products of the fields. Agriculture is the most important industry, 225,000,000 of the population, out of a total of 315,000,000, making their living by farming, forestry, and stock-raising. And with the increased development of irrigation and transportation facilities, the industry is growing rapidly.

The millet grains form the chief crop, for these hardy, drouth-resisting, and prolific cereals are the staple food of the lower classes. Almost the entire crop is consumed at home. Next in importance are rice, wheat, and pulses (lentils, chick-peas, pigeon-peas, etc.). Oil-seeds and oil-producing plants, such as linseed, rape, mustard, sesamum, groundnuts, castor plants, etc., are extensively grown, for the natives use vast quantities of oil for cooking, for their primitive lamps, and for anointing themselves, and many of these oils are exported. Cotton is one of India's most valuable products (*see* Cotton). Other crops of importance are barley, jute, sugar cane, indigo, tea, coconuts, tobacco, and poppies for the production of opium.

It is estimated that there are more cattle in India than in any other part of the world, but they are a hump-backed species of inferior quality, and since the religion of the great majority of Hindus forbids eating beef, the animals are used chiefly for draft purposes. Half-tamed buffaloes are also used in many sections for farm labor, and in the northwest camels are the principal work animals.

ONE OF THE RAJPUTS



This is a Rajput, a member of the fighting and ruling caste of India. The Rajputs are usually of fine appearance, and exceedingly proud of their ancestry. They make some of the finest soldiers in the Indian army.

Among the most important manufacturing establishments of India are cotton mills, jute mills, and sugar mills. Coal, gold, and petroleum are the leading mineral products. Railway development has proceeded further in India than in any other part of Asia. About 40,000 miles are now in operation, consisting of broad gauge trunk lines connecting the large centers of population, and a network of narrow gauge lines. The rivers and canals carry much inland traffic.

The currency of India is based upon the rupee, a silver coin worth about 32 cents. The lesser coins rank as follows: 12 pice make one anna and 16 annas make one rupee. The native custom is to call 100,000 rupees a lakh, and 100 lakhs are called a crore.

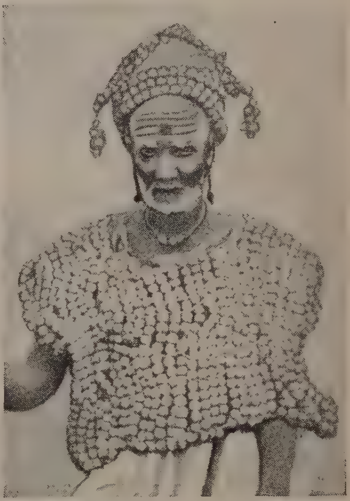
AMONG INDIA'S BEST CITIZENS

These two Bombay merchants are Parsees, descendants of Persian "fire worshipers" who fled to India in the 7th century. The Parsees, who hold themselves aloof from the Hindus, are among the most respected and prosperous people of the land.

India's Tangled History

The early history of India is mostly lost in the mists of ancient traditions. The great Hindu epic poem 'Rig-Veda', written about 1500 B.C., tells of the old struggle between the Aryan invaders and the "black people" who were in possession of the soil. By the 6th century B.C., 16 Aryan states had been established south of the Himalayas, and Brahmanism was flourishing. In 327 B.C. the armies of Alexander the Great reached the Hydaspes River (the modern Jhelam in the Punjab) and the Greek settlements he left behind made a profound impression upon the art and literature of the country. The next 13 centuries were marked by a succession of bitter struggles for power between Indian princes, and by a succession of invasions, among which stand out the inroads of the White Huns in the 5th and 6th centuries A.D. The first attacks of the Mohammedans were repelled, but in the 11th century the Turkish leader Mahmud established the Ghazni dynasty in the land. The Mongol invasion of Genghis Khan followed in 1219 and in 1397 Tamerlane's Tatar hordes poured into India (*see* Mongols). In 1526, Baber, who was a descendant of Genghis Khan as well as Tamerlane, came through the northwest passes from Afghanistan and seized the throne at Delhi, establishing the great Mogul empire which remained intact until the close of the 18th century. The south of India was never completely conquered, but the empire of the north, under such rulers as Akbar and Shah Jehan, was perhaps the most brilliant in the history of the Orient. During the reign of Aurungzebe (1618–1707), the last of the "Great Moguls," arose the power of the Mahrattas in the south, which so undermined the Mogul rule that its last years present a picture of weakness and decay.

A BRAHMAN AND HIS BEADS



The Brahmans form the priestly caste. This one wears a coat and head-dress of holy beads, and carries his "caste mark" on his forehead. Ranking even above the Rajputs, the Brahmans guard their privileges jealously.

Meanwhile the struggle between Europeans for supremacy in Indian affairs had begun. With Vasco da Gama's discovery of the ocean route around the Cape of Good Hope in 1498 there began a race for the rich Indian trade between Portugal, Holland, and France. In 1600 the English East India Company joined in the rivalry, and soon had trading posts at Madras, Bombay, and Calcutta

INDIAN ART

On the left is the famous carved gate at Bhilsa. It dates back many centuries before the Christian Era, and is considered one of the finest specimens of Buddhist art. This gateway stands at one of the four entrances of the Sanchi Tope, the oldest historical ruin in India. The second picture shows the carved pillars in a temple at Delhi. Such elaborate carving is typical of Hindu art.

(then called Fort William). The history of India from that time forward deals chiefly with the long commercial struggles of these European rivals. The French, under the leadership of a brilliant governor, Joseph Dupleix, enlisted and drilled native troops and with these interfered so successfully in native quarrels that by 1751 the Carnatic and the Deccan were under French influence.

Just as British influence was threatened with extinction in India, the genius of Robert Clive turned the tables. First his storm and successful holding of Arcot in 1751 and then his victory at Plassey in 1757 overthrew the French power and laid the foundations of the rule of the English East India Company (*see* Clive, Robert). Later mere trading rights gradually grew into political rule. It was one of the strangest conquests in history, this by which a private trading company conquered an empire by the use chiefly of soldiers (Sepoys) raised in that land itself.

Warren Hastings, who became governor-general for the East India Company in 1774, built soundly upon the foundation Clive had laid. He subdued the Mahratta princes and crushed the famous Hyder Ali, sultan of Mysore (*see* Hastings, Warren). In the next 30 years the rule of the British Company extended over a great part of India. Between 1848 and 1856 the Sikhs were defeated and the Punjab was annexed.

But certain high-handed methods employed by the British Company, together with the teachings of missionaries and the advance of European customs, had stirred a great wave of unrest. In 1857 a rumor was circulated among the native troops enlisted under the British flag that the cartridge papers, which the soldiers must tear with their teeth, were greased with the fat of cows and pigs—the former held sacred by the Hindus, and the latter abhorred by the Mohammedans. This rumor set fire to the tinder of discontent, and the great Indian Mutiny of 1857 was the result. The insurrection spread rapidly in the north. Nana Sahib, a Mahratta prince, besieged a British force in Cawnpore, and, after promising safe-conduct, treacherously massacred his prisoners, including women and children. Another British force was besieged in Lucknow, but after the commander, Sir Henry Lawrence, and many others had been killed, the survivors were rescued. Not until Delhi was captured in September, was the mutiny broken.

The great Pagoda at Tanjore, in the Province of Madras, is 200 feet high and is one of the most striking examples of temple architecture in India. Thousands of sculptured figures cover its walls.

A TOMB AS BEAUTIFUL AS A JEWELED CROWN

The tomb of Itimad-ud-daula at Agra is one of the most magnificent pieces of architecture in the world. It was built in 1628 by Nu Jehan for her father, who was a Persian refugee. The whole of the exterior is of glistening white marble, carved and inlaid with delicate designs. Raised upon a decorated platform in the midst of a beautiful garden, it overlooks the city of Agra—a reminder of India's great past.

This tragic outbreak put an end to the political rule of "John Company." In 1858 its rights of government were transferred to the British government and the last flames of the mutiny were quenched. Since then greater respect has been shown to the religious and other susceptibilities of the people, and about two-fifths of India is still left to be ruled by its native princes.

The remaining history of India is the history of rapid industrial and commercial development, enlivened by occasional border warfare, particularly on the Afghanistan frontier. The specters of famine and plague constantly hang over the land. The educated Indians, particularly the Hindus, have demanded an increasing share of self-government.

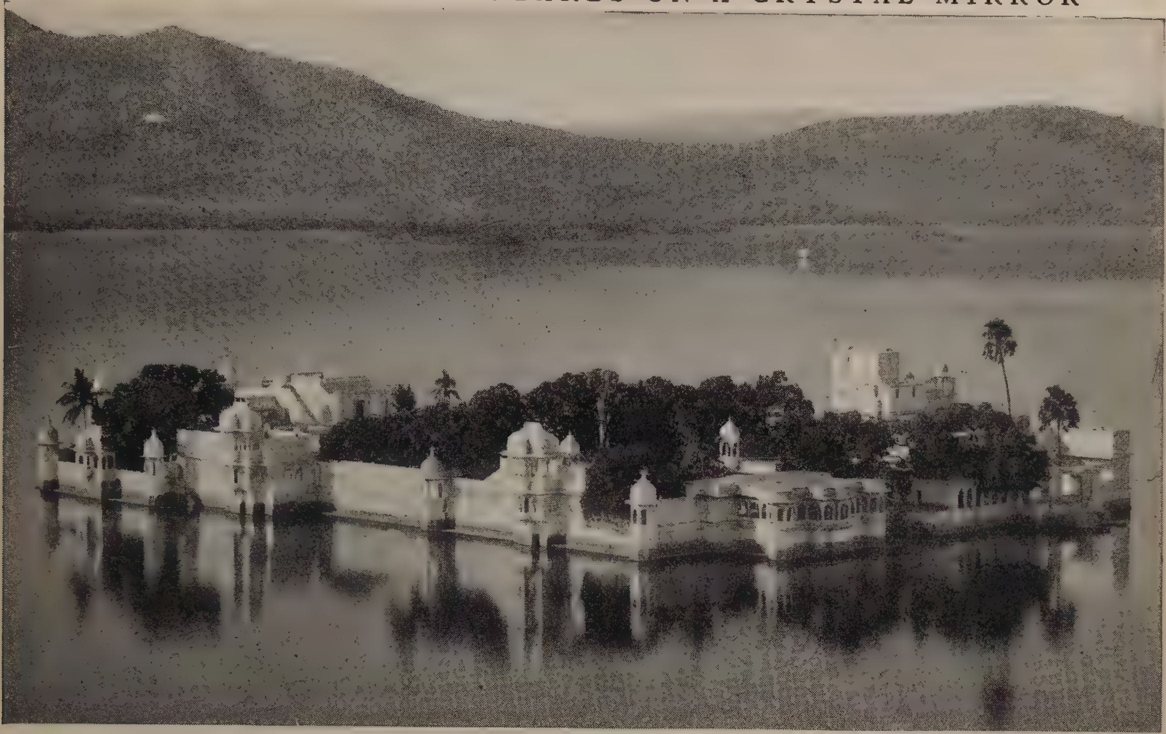
At the outset of the World War, Germany counted upon a repetition of the Indian mutiny to cripple Great Britain's fighting strength, and secret emissaries of the Berlin government agitated among the Mohammedans, urging them to join hands with their Turkish co-religionists in a holy war upon the British. But these schemes failed, and India contributed a generous share toward the cause of the Allies, not only in money but in fighting men. At the close of the war, however, unrest spread throughout the country and culminated in strikes and riots in many of the larger cities. The "Amritsar massacre" in which about 500 natives were killed by the troops was the most lamentable of these disturbances. It was due to the panic and hot-headedness of the general in charge, who was later removed and punished by the British government.

British India, which comprises about three-fifths of the total area of India and more than three-fourths of its inhabitants, is administered in England by a Secretary of State for India. The executive authority in India is in the hands of a governor-general or viceroy, appointed by the British government. He is assisted by an executive council in India consisting of the heads of the various departments of government. The Indian legislature—composed in part of native Indians—consists of two chambers, the Council of State and the Legislative Assembly. It enacts laws governing all persons in the British provinces and all British subjects within native states.

Each of the 15 British provinces has its own governor, nominated by the viceroy. By an act of the British Parliament passed in 1919, eight of the provinces were granted a considerable measure of self-government. Legislative councils containing at least 70 per cent of elected members were set up, bearing a relation to the Indian legislature similar to that between the provincial and Dominion legislatures in Canada.

The native states, about 700 in number, are governed by their own princes, ministers, or councils, under the advice of a British Resident assigned by the viceroy. Some are required to pay an annual tribute. They are restrained from making war or entering into alliances with one another or with foreign powers. The size of their armies is restricted, and in case of gross misrule the British government reserves the right to interfere. But in most other matters the princes have supreme authority.

LIKE A CLUSTER OF PEARLS ON A CRYSTAL MIRROR



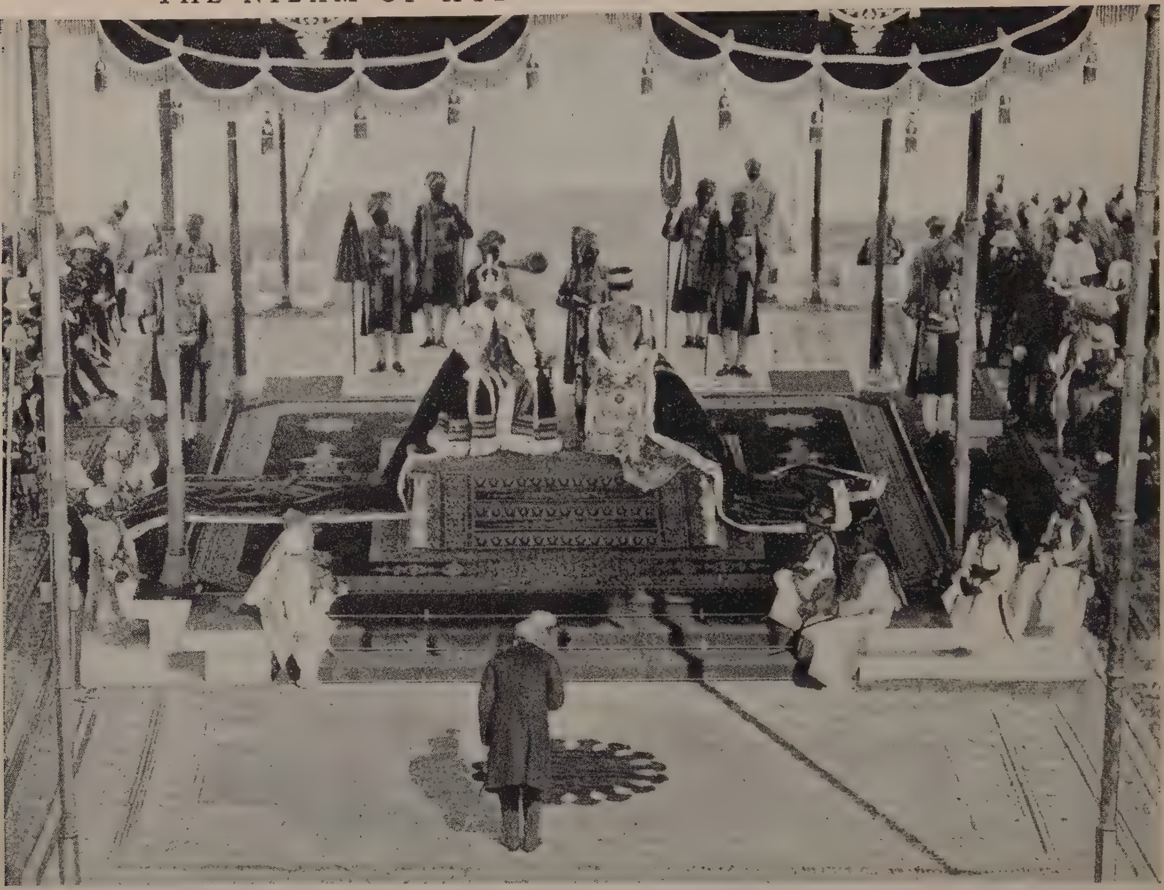
This is one of two beautiful palaces erected on islands in Lake Pichola in the native state of Udaipur. The island is completely inclosed within the marble walls of the palace. It is four acres in extent and, besides the palace buildings, contains three gardens divided from one another by arcaded cloisters in which grow oranges and other tropical fruits.

Architecture is the chief art of India and it has always been distinguished by the same highly decorative style which gives such unique beauty to Indian metal work, jewelry, pottery, and textile patterns. Because most of the early Hindu buildings were of wood and clay, India contains no such relics of ancient architecture as have been left to us in Egypt and Greece, and indeed it is doubtful whether the early Brahman faith encouraged the building of temples. But with the advent of Buddhism and Jainism, monasteries and shrines sprang up over the land. When to these early styles Mohammedan influences were added from the 11th century onward, India developed a varied art of building which gave to the world some of the most beautiful structures in existence. The distinctive feature of Indian architecture is the delicacy and elaborateness of its detail. Some of the temples are covered with mazes of carved figures in unbelievable profusion. Many of the shrines are cut out bodily from the rock, such as the famous underground temples on the island of Elephanta in Bombay harbor. For sheer elegance and grace nothing can compare, however, to the buildings put up by the Great Moguls, such as the world famous Taj Mahal (*see* Taj Mahal), and those erected by their Rajput rivals, including the noted palaces built on the islands of Lake Pichola in Udaipur.

Hindu painting, occupied as it has always been with a grotesque religious imagery, makes no profound appeal to Western eyes. Sculpture suffers from the same fault, and while many of the "pagan gods" are impressive by their size and ornamentation, they cannot be called truly artistic. Much more fascinating is the work of the Indian craftsmen, such as the enameling done by the Sikhs and the damasceening of metal objects in gold and silver wire, which is practiced in Cashmere, in the Punjab, and in the state of Hyderabad.

The earliest Hindu literature consists of the Vedic hymns, of which the 'Rig-Veda' is the most ancient collection. This consists of 1,017 short poems, mostly addressed to the gods, but giving a definite picture of a high civilization existing about the time the Aryan invaders had reached the banks of the Indus and were fighting the "dark people" to the south. To the Vedic poems were attached prose works called 'Brahmanas', explaining the duties of the priests; then were added the 'Sutras', telling of laws and ceremonies; and later the 'Upanishads', treating of God and the soul; the 'Aranyakas', giving directions for leading a holy life; and finally the 'Puranas' or sacred traditions. The two most famous historical poems are the 'Mahabharata' or chronicles of the Delhi kings, and the 'Ramayana' or story of the Aryan advance into southern India. During the period from the 1st to the 8th century A.D. were composed a number of Sanskrit epics and dramas filled with adventure and romance. The old Hindu fables

THE NIZAM OF HYDERABAD PAYING HOMAGE



Seated on the throne erected for the ceremonial at the great Durbar or royal reception at Delhi in 1911 are George V and Mary, King and Queen of Great Britain and Emperor and Empress of India. A part of the impressive ceremonies was the acknowledgment of the sovereignty of Great Britain over India by the rulers of the native states, who in succession passed before their Majesties and paid them formal homage, as the Nizam of Hyderabad is doing here. As the leader among the native rulers, the Nizam of Hyderabad was the first to perform this ceremony.

of animals, which were translated into the Persian as early as the 6th century A.D. and so found their way into Europe, are said to be the basis for many of the familiar nursery stories of England and America.

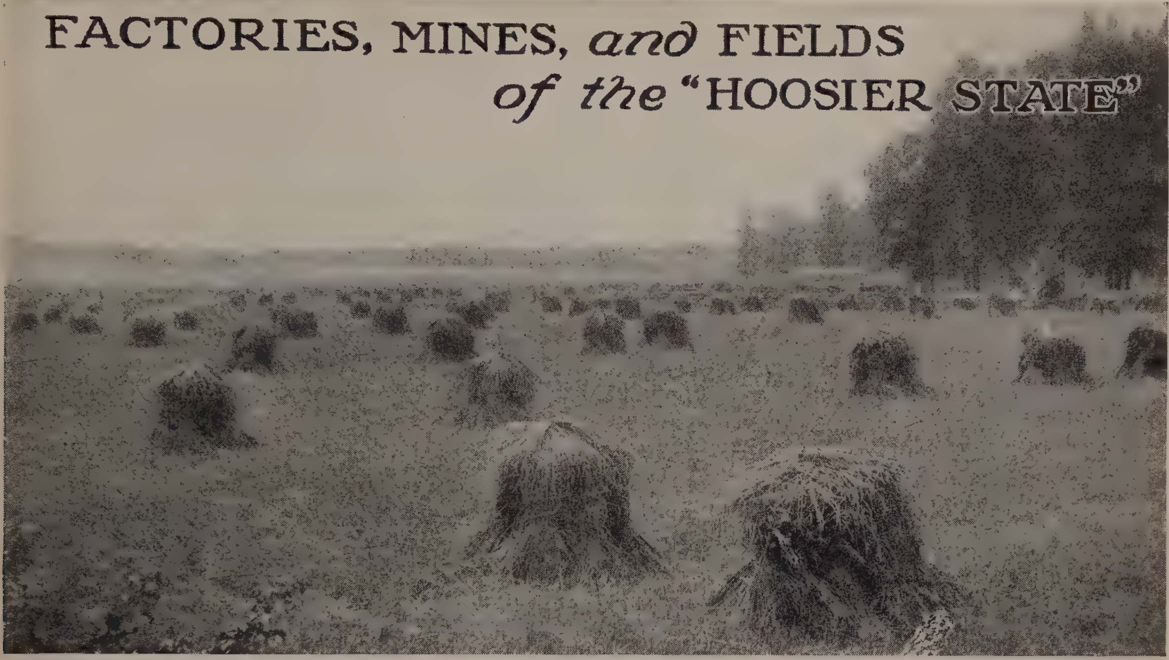
Under the influence of modern education many Hindu writers are developing a new and interesting national literature. Most conspicuous among these is Rabindranath Tagore (1861–) who has attempted to embody in his poems, tales, parables, and dramas the advanced ideas of European civilization, while keeping the best traditions of ancient Hindu idealism. In 1913 he was awarded the Nobel prize for literature, and in 1915 he received the honor of knighthood at the hands of the British crown. Among his best known works are 'The Crescent Moon: Child Poems', 'The Gardener', and 'Sadhana: The Realization of Life'.

There is in India, also, a great revival of interest in science. Centuries ago Hindu astronomers and mathematicians were highly honored and contributed an important share to the development of knowledge. They exchanged ideas with the Greeks at the time of Alexander's conquest, and in the 9th century important Hindu scientific works were translated by the Arabs and so reached Europe, but with the advent of the Mohammedans, science declined, and it has remained for the universities of Calcutta, Madras, Bombay, Allahabad, and the Punjab, and their large number of affiliated colleges to bring back the traditional love of learning to the Indian youth.

The Andaman and Nicobar islands in the Bay of Bengal are also under the Indian administration. The former group, consisting of the Little and the Great Andamans, divided by the Duncan Passage, with a total area of 2,508 square miles, has been used as a penal colony. The natives of these islands are of negrito race and of great interest to scientists. The Nicobar group consists of 19 islands, 12 of which are inhabited. The total area is 635 square miles.

The French, who were once supreme in India, retain the following stations and trading posts: Pondicherry, Karikal, and Yanaon on the Coromandel Coast; Mahe on the Malabar Coast, and Chandernagore in Bengal. These possessions, with a total area of 203 square miles, are administered by a governor residing at Pondicherry. The Portuguese retain a small area on the Malabar Coast called Goa (1,469 square miles), the seaport of Damao, 100 miles north of Bombay, and the island of Diu on the other side of the Gulf of Cambay.

FACTORIES, MINES, *and* FIELDS *of the* "HOOSIER STATE"



Extent.—North to south, 276 miles; east to west, average width, 140 miles. Area, 36,354 square miles. Population (1920 census), 2,930,390.

Natural Features.—Rolling country with numerous small lakes in the north, with rolling hills and low broken ridges and knobs in the south (highest point, 1,053 feet, in Randolph County, 60 miles northeast of Indianapolis). Sand dunes along the shore of Lake Michigan in the northwest. Wyandotte Cave in Crawford County. Principal rivers: Ohio, Wabash, White, Kankakee, Maumee, and St. Joseph.

Principal Products.—Corn, wheat, oats, hay; cattle and dairy products, hogs, sheep, and horses; coal, building limestone, cement, clay; iron and steel products, railroad cars, packing-house products, flour, meal, and other foods; wagons and furniture, automobiles, glassware, brick, tile, and pottery.

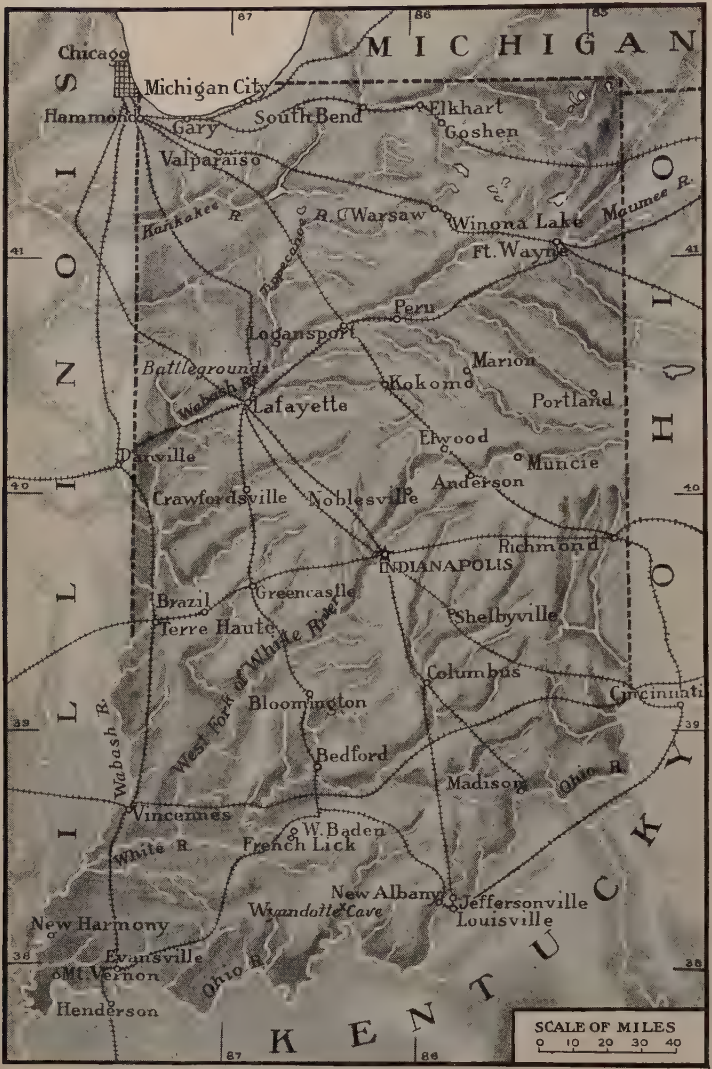
Chief Cities.—Indianapolis (capital, about 315,000), Fort Wayne (87,000), Evansville (86,000), South Bend (71,000), Terre Haute (67,000), Gary (56,000), East Chicago, Hammond, Kokomo, Muncie, Anderson, Richmond (25,000 to 50,000).

INDIANA. "A Hoosier," says George Ade (who is one himself), "is the happy average—happy, because he lives in Indiana!" In spite of its averageness and the fact that its people "are clotted around the exact center of population" of the United States, he claims that the commonwealth "is neither nebulous nor indefinite. It has a soul. It is individual." Why? Because, says Mr. Ade, in his humorous way, through its two early streams of immigration, from the South and later from the East, the state "was settled by pioneers who had the enterprise to seek new fields and the 'gumption' to unpack and settle down when they found themselves in the promised land. Indiana grows all the crops and propaganda known to the temperate zone. If a high wall could be erected to inclose Indiana, the state would continue to operate in all departments, but the outsiders would have to scale the wall in order to get their dialect poetry."

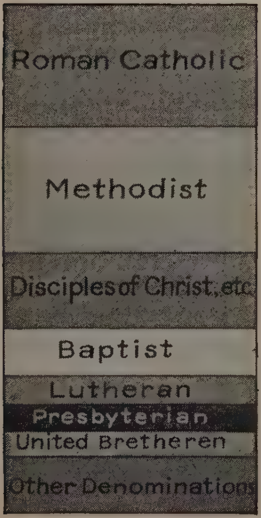
A panoramic airplane view of the state would show us, in summer, a wide green expanse mottled with brown plowed lands and golden fields of ripening grain, seamed with silver rivers, and, especially in the northeast, jeweled with many small blue lakes, memorials of the ice-sheet which once covered this northern region. While the state as a whole might at first glance seem monotonously level, closer scrutiny would show us that even in the flatter northern half there are variations of level; for the glacial lakes of the northeast lie strewn along the furrows between long stretches of steep morainic hills, and along the shores of Lake Michigan the yellow sand dunes—here barren and desert-like, there covered with binder grass, cottonwood, scraggy pines, and oak—sometimes rise to a height of nearly 400 feet. South of the marshy-banked Kankakee the broad glacial plain, spreading across central Indiana without a hill to break its expanse for many an hour's journey, rises near the middle of the eastern border just beyond Muncie to a wide dome 1,053 feet above sea-level, the highest point in Indiana.

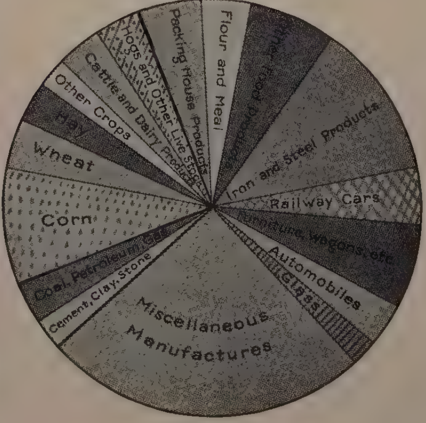
The southern half of the state is more irregular, rolling toward the east and west, and rising in the middle to a broken highland diversified by beautiful valleys, where lies Brown County, beloved of landscape artists. Southward from near Columbus to New Albany, on the Ohio River, runs a range of cliffs, the "Knobstone Escarpment," west of which stretches level limestone country, riddled with many labyrinthine caverns and curious "lost rivers" which, after flowing along surface channels, suddenly plunge into cone-shaped "sink holes" and are lost from sight.

Almost the whole of the state, except the south-central highland, is covered with glacial drift, in some places 400 feet deep, and the spring floods of the Ohio, the Wabash, and the White rivers have for centuries laid down deposits of rich sediment along their courses. This excellent soil and the fairly



The State of Indiana occupies the heart of what is, in many respects, the most prosperous portion of the whole United States. Notice how it was planned, with Indianapolis, its capital, in the exact center of the rolling plains, which are today rich farm lands.





equable climate and ample well-distributed rainfall of the state are the main bases of its wealth. In total quantity of the staple crops—corn, oats, wheat, potatoes, and hay—Indiana ranks fairly high among the agricultural states, and even higher, reckoning by production per acre and quality of the crop. Indiana corn has won many grand prizes and gold medals at national expositions, and special breadmaking value is claimed for flour made from Indiana wheat. Much of the corn raised is fed to stock, especially hogs, for Indiana is one of the six great pork-raising states. Among the minor crops that are still of considerable importance are onions and mint in the northern muck lands, tomatoes in the region a little north of Indianapolis, apples and peaches in the south-central part, cantelopes and watermelons in the southwest corner of the state, and tobacco in some of the Ohio River counties. Dairy cows, horses, and poultry are also important sources of farm revenue. Most Indiana farmers are American born of native white parentage. There is as yet no marked tendency toward large-scale agriculture; in fact, the average size of a Hoosier farm is 100 acres.

Indiana is a well-watered state, and its rivers, flowing through its early history—"with a strange tumult of battles, treaties, treacheries, massacres, gradually softening down to the sweet murmurs of peace"—meant much to its early development. The Wabash River system, bending eastward over the state like a lopsided elm tree before a western gale, drains the greater portion. The Ohio and its tributaries drain the southern border; and the northern portion is drained into Lake Erie by the Maumee and its tributaries, into Lake Michigan by the St. Joseph, and into the Illinois by the Kankakee. All these streams floated the canoes of the French trappers, fur traders, and Jesuit missionaries in the 18th century. The Ohio and its tributaries largely determined the course of the first immigration from Virginia, Kentucky, and the Carolinas, by which the southern portion of the state was settled in the late 18th and early 19th centuries. Many a pleasant, quiet stream was reddened in those early days by border battles now half-forgotten; only the name of the Tippecanoe, where the Shawnee Prophet was de-

A PATCH OF WILDERNESS SURROUNDED BY CIVILIZATION

For many miles along the Indiana shore of Lake Michigan stretches a range of sand-hills known as "the Dunes." Immediately back of this range is a prosperous farming country, and it is flanked at both ends by thriving industrial communities, but the dunes themselves are bare of inhabitants, save campers and picnickers. Curiously enough, many forms of semi-tropical vegetation, such as orchids and fly-catching plants, are to be found among these hills.

feated and the splendid dream of his great brother Tecumseh was shattered, remains memorable to this day. The lower Wabash, the lower White, and the Ohio rivers were highways for early commerce; and from 1820 to 1840 nine-tenths of the surplus produce of Indiana was shipped by flatboat down these streams to the Mississippi and to New Orleans. Today the only waterways in use in the state are Lake Michigan and, to a very limited extent, the Ohio River, the lower Wabash, and a small part of the White; nor are the rivers used to any great extent for water-power. The water supply of Indiana streams, variable at best since the destruction of the once great forests, has grown too irregular for profitable use.

No one could guess from the aspect of Indiana today that when the first settlers entered it the greater portion was covered with dense growths of magnificent hardwood trees—oak, walnut, beech, ash, maple, and the king of the Wabash valley, the giant sycamore—in all, more than 40 kinds of trees, which not infrequently reached a height of 100 to 190 feet and a circumference of 25 to 35 feet. It makes one shudder to realize that most of these huge and splendid forest monarchs did not even furnish timber or fuel, or serve any useful purpose. They were simply cut, piled in heaps, and burned with immense labor to clear the land for planting. It could not be helped. The forest was a barrier to progress, a foe to agriculture, and a refuge for Indians, bears, panthers, wild cats, and lynxes, as well as for deer and other gentler wild creatures.

The stout Hoosier pioneers, snatching at every opportunity to sweeten toil and hardship with fun and frolic, made the "log-rolling" a community festival. The 20 to 50 men of a neighborhood would gather early in the day with axes and handspikes at the home of one of their number, and, divided into opposing squads, would make a game of seeing which side could outdo the other in heaping the logs for burning. In the log cabin their women folk were busy quilting and preparing the feast of venison, roast turkey, fried chicken, hog, hominy, potatoes, hot cornbread, biscuit, and gingerbread, pies, preserves, milk, and cider. In the evening the young people would still have energy left for dancing and games, while a hundred flaring log bonfires lit the sky. Each settler received the same help from his neighbors, so the festivity was repeated many times during the season, usually April or May. The log-rolling was a splendid opportunity for political candidates to ingratiate themselves with the voters; an opportunity, too, for the canny farmer, who, it is said, would sometimes postpone his log-rolling until campaign time in order to profit by the enthusiastic labor of rival candidates. ("Log-rolling," by the way, still remains in our political vocabulary as a term for barter of political favors and services.)

The energetic pioneers, alas! did their work of clearing all too well. Today most of the standing timber is undesirable second growth, much hillside soil has been washed away, ruining many farms, and the navigable streams have deteriorated.

Though its interests were long chiefly agricultural, Indiana has been developing industrially during the last half-century. Its two chief advantages for manufacture are its situation across the path of east-and-west travel, and touching Lake Michigan, and its extensive native coal supplies. To these two factors mainly it owes the almost miraculous growth of the industrial towns on the northeast border—Gary, Hammond, East Chicago, and Whiting—which largely share in the railroad facilities of their big neighbor, Chicago. Here, particularly at Gary, is concentrated the most important industry of Indiana, steel manufacture; for here Pennsylvania coke, Indiana and Illinois coal, Indiana limestone, and Lake Superior iron ore can be readily and cheaply assembled.

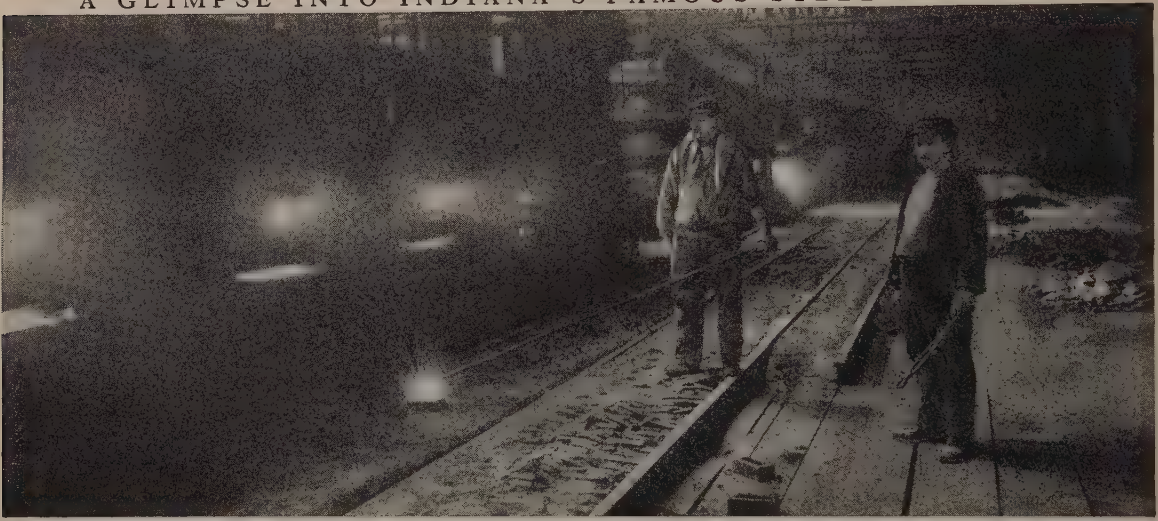
The raw materials for the next most important industry, slaughtering and meat-packing, are supplied by Indiana's farms. Three-fourths of the state's meat products are put up in Indianapolis, which is the chief railroad center as well as the largest city and state capital. Evansville, Terre Haute, and Fort Wayne also have meat-packing interests.

Manufactures which rank next after steel and meat-packing in importance are foundry and machine-shop products, turned out at Gary, Fort Wayne, East Chicago, Whiting, Terre Haute, and elsewhere; the manufacture and repair of railroad cars, at Hammond, Gary, Fort Wayne, East Chicago, Michigan City, and Jeffersonville; flour and grist-mill products, at Evansville, Richmond, and Terre Haute; and automobiles, at Indianapolis, Muncie, and Kokomo. The manufacture of agricultural implements is an important industry in which South Bend leads.

The first powerful impetus to Indiana manufactures was due to the discovery in 1885 of natural gas in northeastern Indiana, and later toward the center and southeastern part of the state. Many Indiana towns, such as Anderson, Elwood, Fort Wayne, and Muncie, were industrially stimulated by the cheap fuel supply; and when the gas was exhausted, the soft coal supplies from the southwestern part of the state took its place. There are about 50,000,000,000 tons of Indiana coal reserves; but only about 14,000,000,000 tons can be easily mined; about 1/18 has been mined already. Petroleum in commercial quantities was discovered in the Indiana portion of the Lima-Indiana field a few years after the discovery of natural gas. Oil production also has fallen off greatly from its first great production; and the two important refineries, at Whiting and East Chicago, respectively, operate chiefly on oil pumped in through pipe lines from the Mid-Continent field.

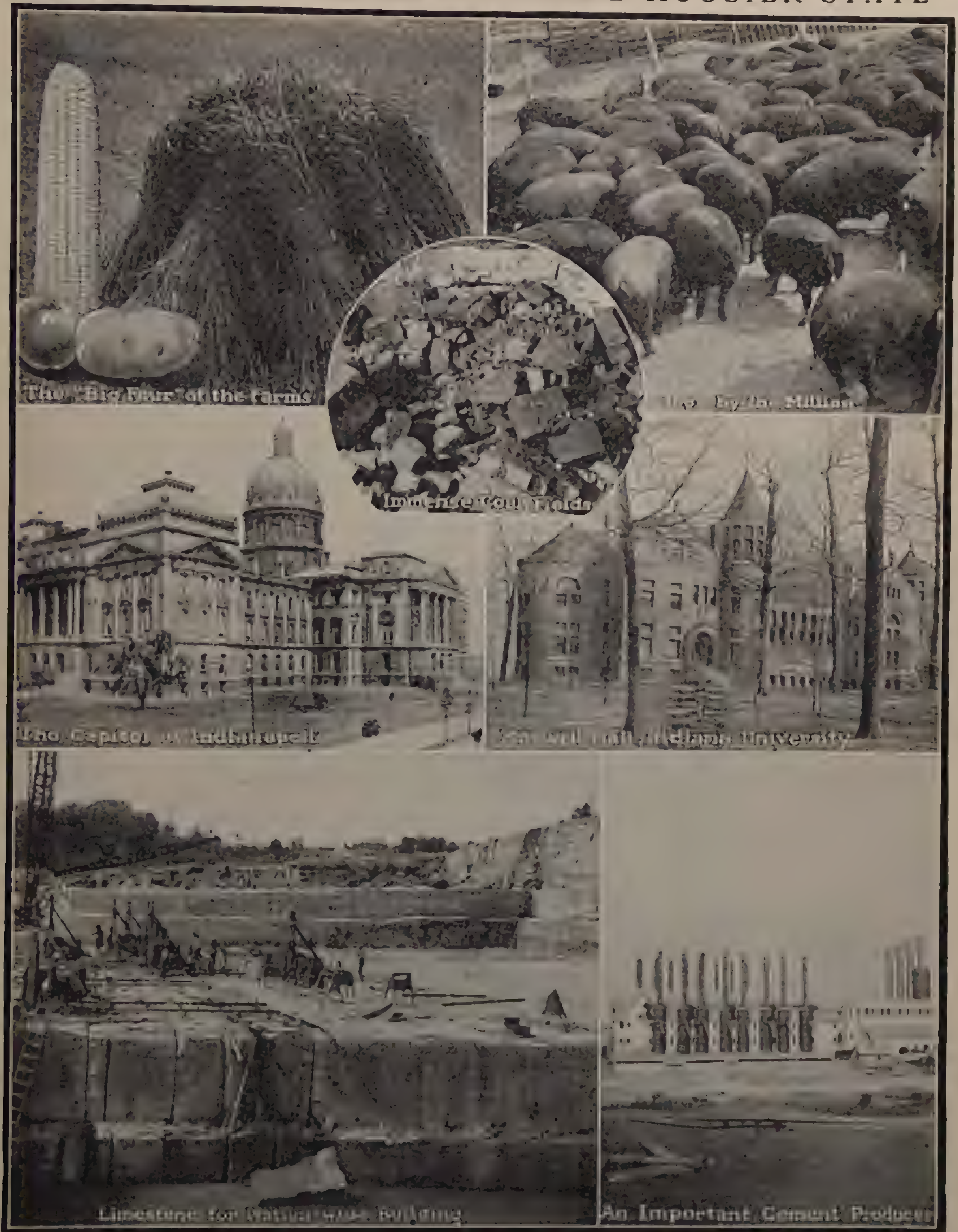
Among other native mineral products used in Indiana manufactures are marl and clay, used particularly in making portland cement, an industry in which the state ranks high; building, foundry, and glass sands, the last-named used at Muncie, Kokomo, Terre Haute, and elsewhere in glass manufacture; kaolin and other clays and shales used at Terre Haute in various pottery products; and limestone, used both for making lime and for building stone. The oölitic stone known as Bedford or Indiana limestone is prized and used all over the Union and forms an important industry. The mineral springs, chiefly in the southern part of the state, around which have grown up watering places like French Lick and West Baden, furnish waters for bottling and export.

A GLIMPSE INTO INDIANA'S FAMOUS STEEL INDUSTRY



Here we are in one of the many steel mills which make northern Indiana a famous metal-producing center. The glaring holes are the openings to the open-hearth furnaces, through which skilled workers watch the metal, and draw samples, as the workman has just done. The furnaces are tapped from another working floor, which is out of sight behind the row.

INTERESTING FEATURES OF "THE HOOSIER STATE"


The "Big Four" of the Farms
by the Million
Immense Coal Fields
The Capitol at Indianapolis
Indiana University
Limestone for Nation-wide Building
An Important Cement Producer

Indiana's wealth is drawn largely from her abundant natural resources. Corn, apples, potatoes, wheat, and hogs come from her rolling fields, and underground are stores of coal, gas, and excellent building stone. In the great region in the north from Chicago to Gary are some of the country's largest steel mills. Indiana is also fortunate in possessing raw materials for cement making. The building stone quarries of Indiana are among the most famous in America. The picture in the lower left-hand corner shows how the noted "oölitic" limestone is cut right out of the earth in great blocks for shipment to all parts of the country. Indiana also has large quantities of fine clay for brick and tile making.

Most of the industrial towns are situated in northern Indiana. This is partly because the people from the South, who mainly settled the southern half of the state, were more inclined to agriculture than to manufacture; partly because of the early start given to the northern industries by natural gas; and very largely because of the superior transportation facilities given by the railroads and Lake Michigan to the northern part of the state.

How the State was Settled

Yet this northern region was not settled until long after the southern portion had become comparatively well populated. This, too, was due to transportation conditions. Until the National or Cumberland Road was opened up in 1834, from Cumberland, Md., to Indianapolis, there was no avenue of approach for the north comparable to that afforded by the Ohio and lower Wabash for the south. About the same time a road was constructed across the state from Lake Michigan to the Ohio—that is, from the site of Michigan City through Indianapolis to Madison; and lake traffic began to be important with the settling of Chicago. From this time on a tidal wave of immigration swept over northern Indiana from New England, New Jersey, New York, and Ohio. The present transportation facilities of the state include service from the main steam railways between the Atlantic seaboard and Chicago and St. Louis, besides many north-and-south lines, and an exceptionally well-developed system of electric interurban lines.

The educational system of the state is completed by two institutions of higher learning, Indiana University at Bloomington and Indianapolis (which includes the state schools of liberal arts, law, and medicine), and Purdue University at Lafayette, which comprises the state schools of agriculture and mechanic arts. In addition there are a number of normal schools and non-state colleges.

The Hoosier is a natural story-teller, and the homespun literary tradition of Indiana is a direct heritage from pioneer times. Edward Eggleston's 'Hoosier Schoolmaster' was one of the earliest attempts to picture the raw frontier life of this country in fiction. Some Indiana writers, like that "Hoosier Arab," Lew Wallace, have gone abroad for inspiration, but others glory in being "provincial." James Whitcomb Riley is by common consent the state's poet laureate, and Booth Tarkington, George Ade, and Meredith Nicholson are among Indiana prose writers who have won more than local fame.

La Salle's Visit in 1669

The first white man of whom we have record as visiting Indiana was the Frenchman La Salle, who crossed the portage at South Bend in 1679. For 50 years thereafter only roving fur traders and Jesuit missionaries shared these forest solitudes with the Indian tribes. The French made the first permanent white settlement, not later than 1727, at Vincennes. Seized by the English following the fall of Quebec in 1760, then wrested from them during the Revolution by George Rogers Clark and his Virginia riflemen in 1778–79, the Wabash country under American control became part of the Northwest Territory. This was divided in 1800, the western part, including the present states of Indiana, Illinois, and Wisconsin and parts of Minnesota and Michigan, becoming Indiana Territory. Shorn successively of the territories for these states, Indiana was reduced practically to its present limits by 1809.

The first territorial governor was the brave and sagacious William Henry Harrison, later president, whose task it was to break Indian power during 1810–12, particularly by the battle of Tippecanoe, Nov. 7, 1811. In 1816 the state was admitted to the Union. The Indian title over the middle third of the state was not cleared until 1818, when what is known as the New Purchase was opened to settlement. In 1820 Indianapolis was founded as the capital, and in 1825 the state government was removed thither from Corydon, the capital since 1813.

Between 1816 and 1830 the population of Indiana had increased from about 65,000 to nearly 350,000. With the opening up of the northern part of the state, the offices for the sale of public lands became overwhelmed with business; and for a time Crawfordsville, the "town in the big flat woods," was the busiest land office in the United States. Between 1828 and about 1838 the state was "delirious with the fever for internal improvements." Roads, when properly constructed, remained a permanent gain; but the canals proved a failure. The whole program left the state bankrupt. Led by a great war governor, the iron-willed Oliver P. Morton, Indiana responded whole-heartedly to the call of the Union during the Civil War.

INDIANAPOLIS, IND. The symmetry and much of the beauty of Indianapolis arise from the fact that it is a "made-to-order" city. In 1820, four years after Indiana had been admitted to the Union and two years after the Indian title to this region was extinguished, the state legislature determined to plant the capital in the exact geographical center of the state. A site was selected on the west fork of the White River, in the midst of a great forest. The trees were cleared away, a circular plaza was marked off in the center of a four-block square, and diagonal avenues laid out radiating from each of the four corners. The rest of the streets were arranged in regular checker-board style. The magnificent trees cut down by the settlers in their ruthless war upon the forest had later to be replaced by others for shade. These have flourished greatly, giving Indianapolis the distinction of being one of the "forest cities" of the west.

Aside from its central location, Indianapolis has no great natural advantages, for the White River is not navigable at this point, but the early enterprise and the prosperity of its citizens soon attracted railway builders. The first line reached the city in 1847, and others followed rapidly. Today nearly a score of railroads radiate from the city, making it the largest city of Indiana and one of the most important commercial and industrial centers of the Middle West. It is also perhaps the greatest interurban electric railway center in the world. About 20,000 people a day enter and leave the city by the handsome union interurban terminal station.

Among the notable public buildings are the State House and the County Court House, both built of the oölite limestone for which Indiana is famous and symmetrically placed at equal distances from the central plaza. In this central plaza, called Monument Place, where the Governor's Mansion stood in early days, is the beautiful Soldiers' and Sailors' Monument, 285 feet high, counting the 38-foot bronze statue of Victory which crowns it. The fountains at the base are said to be among the largest in the world, with a capacity of 18,000 gallons a minute.

The city has several important educational and charitable institutions. Among them are branches of the State University (including the School of Medicine); Butler College, located in a beautiful suburb to the east known as Irvington; Indiana Institution for the Education of the Blind, and Indiana Institution for the Education of the Deaf and Insane. Outside the city is an army post, Fort Benjamin Harrison. The motor speedway, a 2½ mile oval, is world famous. Important coal deposits not far from Indianapolis have served the city's thriving factories since the failure of the once abundant natural gas. Meat-packing is one of the most important industries, and the stock yards cover an area of 100 acres. There are also important iron foundries, flour mills, car shops, automobile, wagon, and carriage factories, furniture factories, and drug manufactories. Population, about 315,000.

IN THE BUSY CITY OF INDIANAPOLIS

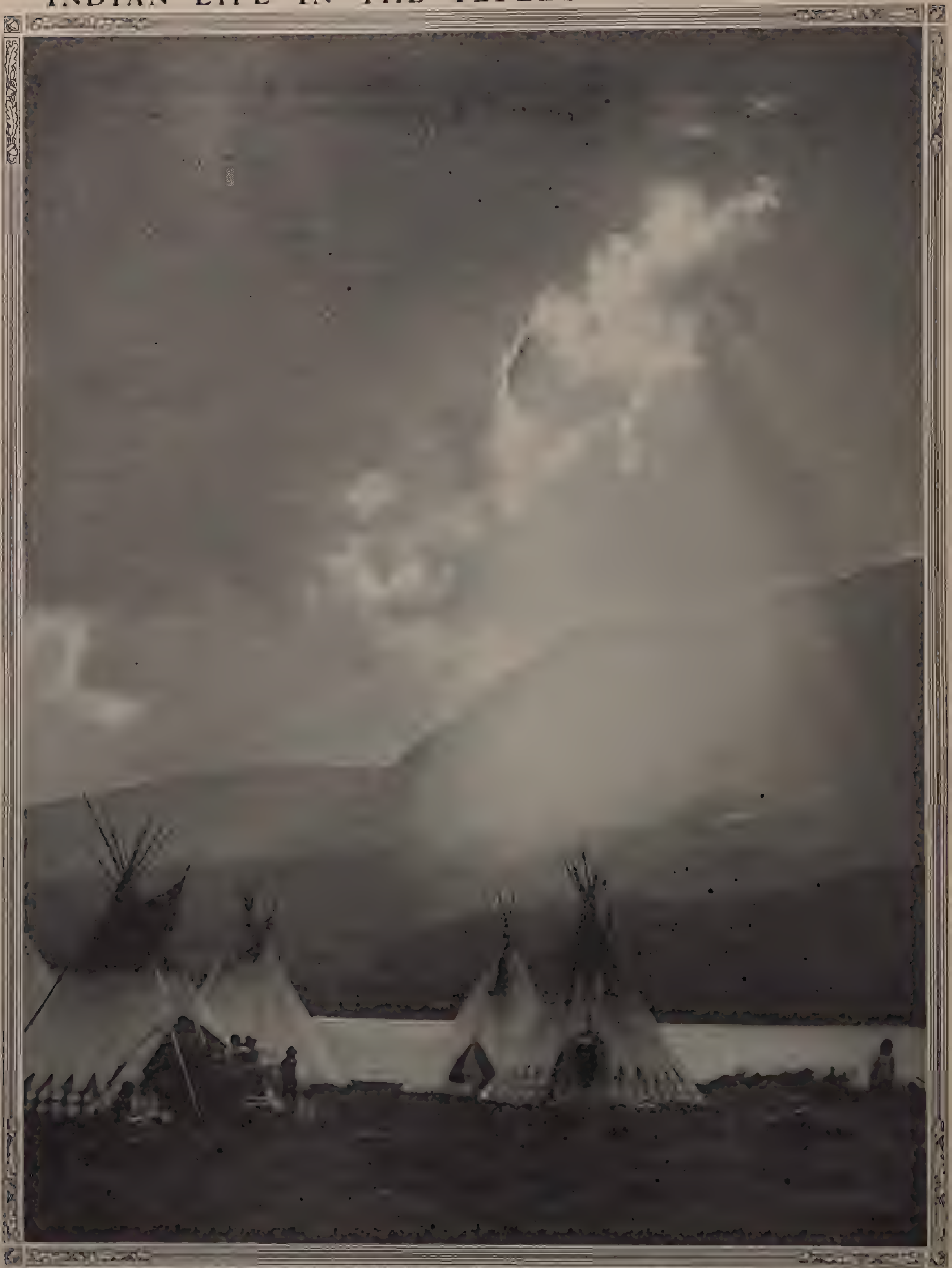
This is a view in the center of the business district of the Indiana capital, showing the Merchants' Bank Building in the foreground.

INDIAN OCEAN. Two thousand years ago, when mariners were still venturing only the most cautious coastal voyages along the Atlantic coast, the Indian Ocean could already boast established trade routes, and the Egyptian Greeks boldly made their way across the open sea between Arabia and Hindustan though they had neither chart nor compass. They had nothing to fear if they avoided the hurricane months from December to April, for they had observed that the monsoon winds blow half the year in one direction, half the year in the opposite.

Washing the shores of Asia on the north, the Antarctic continent on the south, Africa on the west, and the East Indian islands, Australia, and Tasmania on the east, the Indian Ocean is the third largest of the five oceans. Its length from north to south is somewhat over 6,500 miles, its breadth 4,000 to 6,000 miles, and its area about 27,500,000 square miles. The average depth is between 11,000 and 14,000 feet, the deepest sounding so far being 20,340 feet off the southeast coast of Java.

At Cape Comorin, the southern tip of India, the Indian Ocean forks into the Bay of Bengal on the east and the Arabian Sea on the west, the latter branching again into the Persian Gulf. Beyond the Arabian peninsula it connects with the Red Sea. From Asia several great rivers enter it, the Ganges, the Brahmaputra, the Irrawaddy, the Indus, and the junction of the Tigris and Euphrates known as the Shat-el-Arab; and from Africa the Zambezi and the Limpopo. Its great islands are Ceylon and Madagascar, the rest of them—the Laccadives, the Maldives, Socotra, the Andamans, Nicobar, Mauritius, Reunion, Kerguelen's Land—being mostly small groups of volcanic or coral formation.

INDIAN LIFE IN THE TEPEES OF OLDER DAYS

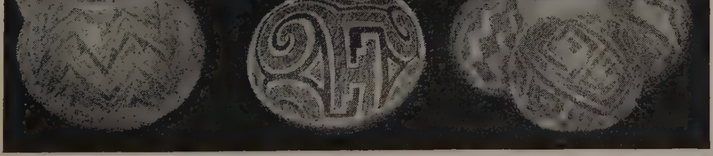


What small boy has not envied the Indian his roving life in the curious pointed tents made of skins, which he could take wherever fancy willed? Here is a group of these Indian dwellings, photographed on the shore of Saint Marys Lake in Glacier National Park. They fairly breathe the story of older days, when scouts, hunters, trappers, and Indians mingled in a life whose stories still set our pulses beating with the fever of adventure.

OUR RED-SKINNED COUSINS—the First Americans

INDIANS, American. When Columbus landed in the New World on Oct. 12, 1492, he found himself among strange-looking people of bronze or copper-colored skins and straight black hair. In his letter to the king of Spain telling of the land, Columbus called these natives *Indios*, because he thought he had reached India. This mistake of Columbus has been handed down to the present day, for we still call these people "Indians" though we add the word American to differentiate them from the natives of the real India, which lies on the other side of the world. Some learned men who have studied the American Indians have shortened the name to "Amerind." They are also called the red race, redmen, and redskins, though really there is not so much red in their faces as there is in the pink-cheeked white men.

When men found that these people were not natives of the real India, they began to wonder where they came from. Some said that they were the ten lost tribes of Israel; others that they came from western Asia. This last may be true, for the Indians resemble the Mongolians of Asia. Their eyes have a slight slant though not so much as have those of the Chinese, they have high cheek bones, and their hair is black as is that of the eastern Asiatic peoples. And the northern tribes of Asia are Eskimo, the same as one of the northern peoples in America (*see* Eskimos). But if the Indians came from Asia, they must have come centuries before Columbus, or even Leif Ericson and his Northmen, discovered America.



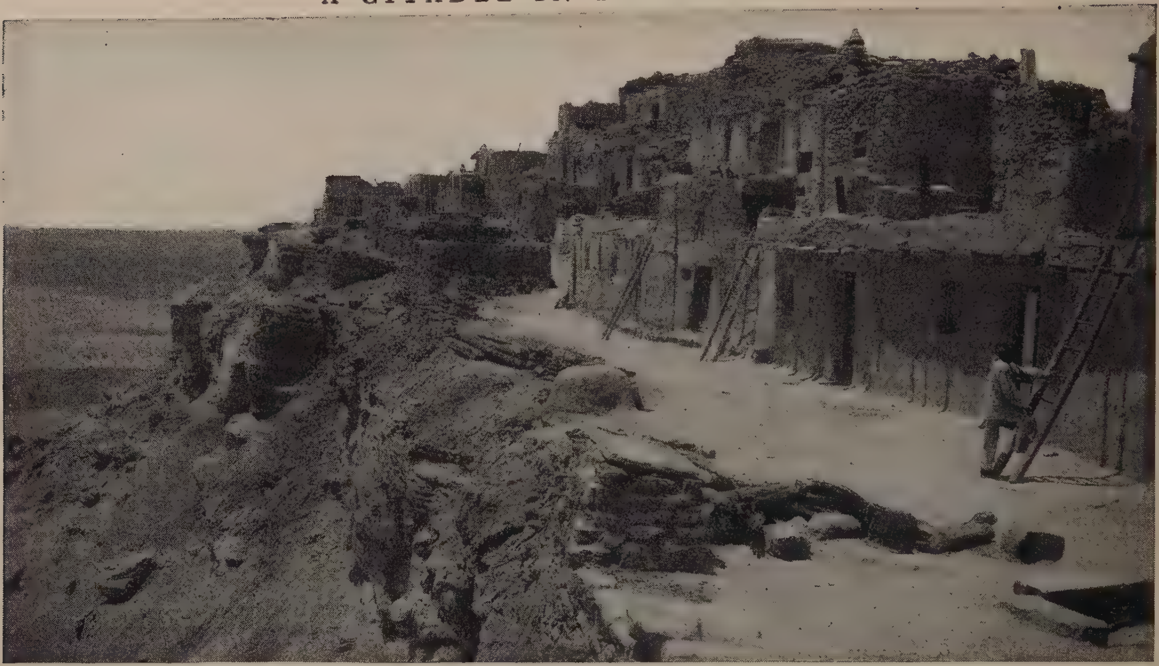
Doesn't it seem strange that a people who in other respects were crude and savage should have had the art instinct so strong that they would carefully decorate their household utensils, as the Tularosa Indians of New Mexico did with these pieces of pottery? It seems that, since time began, the impulse to create art has been as natural as the appetite for food.

It is hard to describe the American Indians and the way they lived, for there were many different tribes just as there are many different nationalities among the white race, and their appearance and ways of life and their languages were different.

The white settlers on the Atlantic seaboard first came into contact with the Indians of the eastern wooded area, who roamed over all the land on both sides of the Great Lakes from the Mississippi River to the Atlantic Ocean. They numbered several hundred tribes and spoke many different languages, but all lived in the great forests and had somewhat similar traits and customs. They practiced agriculture to some extent and used wild rice as food, but depended largely upon the chase for their existence.

Most of the Indians in this region belonged to the Algonquian group, which included the Delawares (or Lenape), Potawatomies, Sauks (Sacs) and Foxes, Kickapoos, Piankishaws, Narragansetts, Mohicans (or Mohegans), and many others. The French explorer Cartier met members of this family when he ascended the St. Lawrence, the English colonists encountered

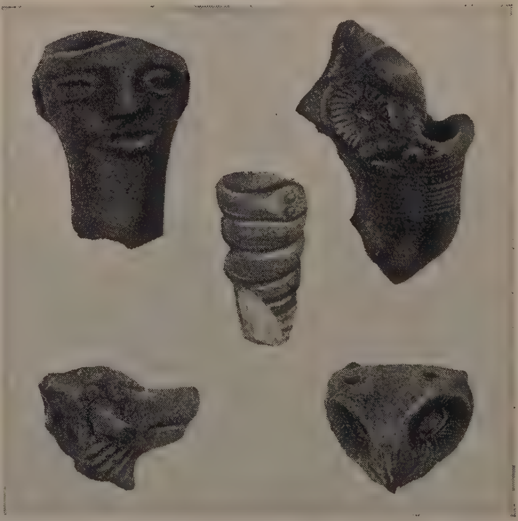
A CITADEL IN THE DESERT



The Hopi Indians of the southwestern United States used to build their villages on flat-topped hills or mesas like this, as a protection against their enemies. Some of the houses were constructed on the roofs of others, and were reached with ladders. A few of these old villages are still inhabited.

them on the coast of Virginia, the New Englanders fought them in King Philip's War, and William Penn made a treaty with them on the site of the present city of Philadelphia. These Algonquian tribes had a high degree of clan organization, and at various times formed great confederations against the whites.

THE PIPE MAKER'S ART



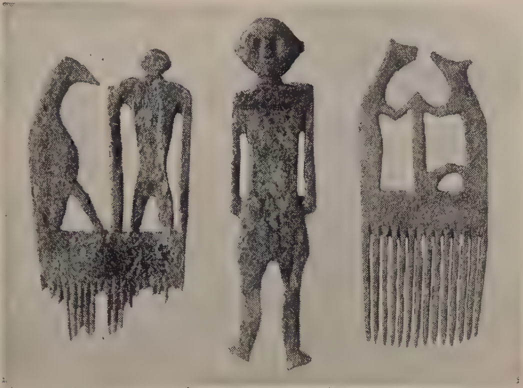
Here are more interesting examples of art among primitive people—fragments of the stone pipes of the Iroquois Indians carved into strange forms.

Living in the midst of the Algonquian territory, in what is now New York state, were the warlike Iroquois. They were sometimes called the Five Nations, for the Mohawks, Oneidas, Onondagas, Cayugas, and Senecas were united in a confederacy—a sort of "league of nations"— to abolish war among themselves. After 1715, when the fierce Tuscaroras joined them, the confederation became known as the Six Nations. But though they abolished war among themselves, their name carried terror to the whites and to other redskins. For many years they fought the Frenchmen, who first won their hatred when Champlain aided their enemies, the Hurons and Algonquians (*see* Champlain, Samuel de). They destroyed all except a few isolated settlements of the Hurons, and they drove the Ottawas from the vicinity of the river in Canada which still bears their name.

South of the Algonquians and Iroquois, and extending from the Carolinas and Georgia to Texas and Arkansas, lived a race of Indians who were weaker in war than their northern neighbors, but nevertheless formed one of the highest types of Indian culture north of Mexico. They were an agricultural people, living in permanent villages, and made good pottery and some cloth. Like the woodland Indians, they had complex political organizations and religious ceremonies. Their principal tribes were the Cherokees, Creeks, Chickasaws, Choctaws, Seminoles, Apalachicolas, Natchez, and Tuscaroras.

The greatest rovers among the Indians were those who inhabited the great plains between the Mississippi and the Rockies. These tribes lived almost entirely upon the buffalo, which furnished them with food, clothing, and shelter. They made no pottery, wove no cloth, and did not practice agriculture; they roamed at will over the prairies, setting up their tents of buffalo hide (tepees) wherever the buffalo led them. Typical tribes of this group were the Sioux, the Assiniboins, Arapahoes, Blackfeet, Crows, Cheyennes, Comanches, Gros Ventres, and Dakotas. On the eastern border were the Mandans, Omahas, Osages, Pawnees, and Wichitas, who sometimes lived in earth or grass-covered houses in permanent villages, though using tepees when on the hunt. In the northeast around Lake Winnipeg were the Cree and Ojibwa, and in the far west the Nez Percé, Shoshone, and Ute tribes.

COMBS WORN BY INDIAN BELLES



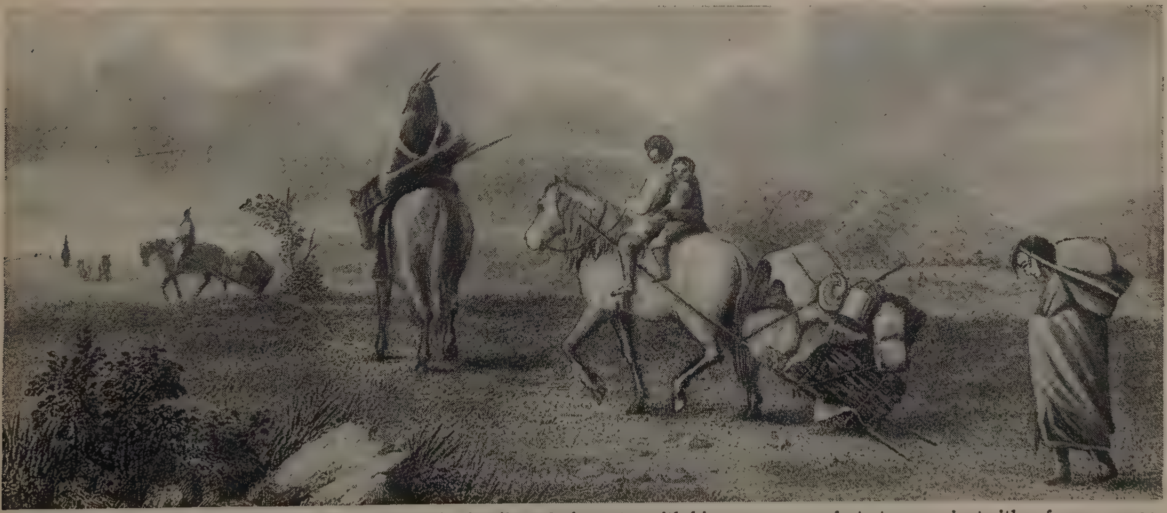
As far back as we have any record, women have used combs in dressing and decorating their hair. These combs made from the antlers of deer at one time adorned the black locks of Iroquois belles. The figure in the center was once part of a comb.

These three great divisions include the Indians with whom we are most familiar, those whose deeds are recorded in the general history of North America. But there were many others besides these. In the southwest, chiefly in Arizona and New Mexico, were the Pueblo Indians, whom Cortez and Coronado found living in their homes of sun-dried brick, and whose descendants live in the same sort of houses today. They comprised the Hopi, Zuni, Taos, Apache, Mojave, Yuma, and Maricopa tribes, and the Navajos, whose beautiful blankets are justly famous. In California and the Great Basin lived the "digger" Indians, a mild race of low intelligence, who existed upon acorns (from which a kind of meal was produced), the seeds of wild grasses, and roots. Their principal tribes were the Washos, Yumans, and Maidus. On the plateaus in the Northwestern States and in British Columbia were found the Bannock, Snake, Nez Percé, Flathead, and Kutenai (Kootenay) Indians, who lived largely on salmon from the Columbia River and vegetable foods, but practiced no agriculture. In the north they sometimes lived in underground houses, and in the south brush shelters were common.

On the northern Pacific coast lived a race of canoeists and fishermen, highly developed in wood work, who built elaborately carved totem poles before their homes to show to what clan the inmates belonged. The most typical tribes of this north Pacific area were the Tlinkits, Nootkas, Bella Coolas, and Chinooks. Many of these western Indians are of the great Athabascan stock, the principal tribes of which are found in Alaska and Canada. In the cold north they lead a life similar to that of the Eskimos, but farther south they lived in tents and depended on the caribou as the Plains Indians did on the buffalo.

We know now that there were other tribes of Indians who had disappeared before the coming of the white man. These were the mysterious "mound-builders," whose grass-grown mounds dot the northern region between the Alleghenies and the Rockies. For a long time people wondered about these queer-shaped mounds, many of which resemble animals'

AN INDIAN MOVING DAY



Among tribes that possessed horses, the head of the family rode in state, with his weapons ready to turn against either foes or game. In place of a wagon, a long pole was fastened to each side of the draft horse, and all the baggage possible was lashed to the dragging ends of these poles. The squaw carried what was left on her back, with a leather thong about the forehead to help support the load.

figures. But now, since many of the mounds have been dug into, it is fairly well established that they were the work of some ancestors of the Indians that the colonists knew (*see* Mound-Builders).

The Indians that the Puritans Met

The Indians that the Puritans met in the Massachusetts wilderness were like others of the race, of a coppery or reddish-brown color. They had abundant long straight black hair and high cheek bones. The Puritans did not like their redface neighbors very well. The ways of the Indians were not their ways. They distrusted a person who would not fight in the open, but slipped upon his foe unawares. And yet to the Indian this craftiness was a mark of superiority. He considered it only a matter of strength to kill an enemy in the open, but to be able to steal upon him and kill him from ambush showed skill and cunning.

But though the Indian was a bad enemy, he was a good friend. His generosity in furnishing the colonists corn sometimes saved them from starvation. His instruction in planting corn and fertilizing it with fish waste enabled his paleface brothers to care for themselves. And the friendly warning of a friendly Indian at times saved the Puritans from massacre by hostile braves.

When the whites first came to America more than 200 languages were spoken north of Mexico and the number of dialects ran beyond a thousand. The settlers could learn an Indian language only by talking to the redmen, for none of the tribes they met had any form of writing and no tribe anywhere in America had more than a rude picture writing. Figured wampum belts were often used to help the redmen remember the details of treaties or of important events. In every tribe there were legends, some more fanciful than true, of the history of the tribe. And when the day's work was done and all were gathered around the camp-fire, the old men and old women would tell these tales.

The women did what seems to us the hardest work. They planted the squashes, and the corn and beans from which they made succotash, an Indian dish which we have borrowed. They dressed the skins of the animals and made the clothes for the family. They cooked the meat on sharp sticks over the fire. They cared for the children. Until the papoose was a year old they carried the baby on their backs or hung the board cradle on a tree while they did their work. And when the family wigwam was moved it was the squaws who carried the burdens and set it up in its new location, and built the camp-fire—which was not an easy task when we remember that the Indian had neither matches nor flint and steel, but made fire by rubbing pieces of dry wood together.

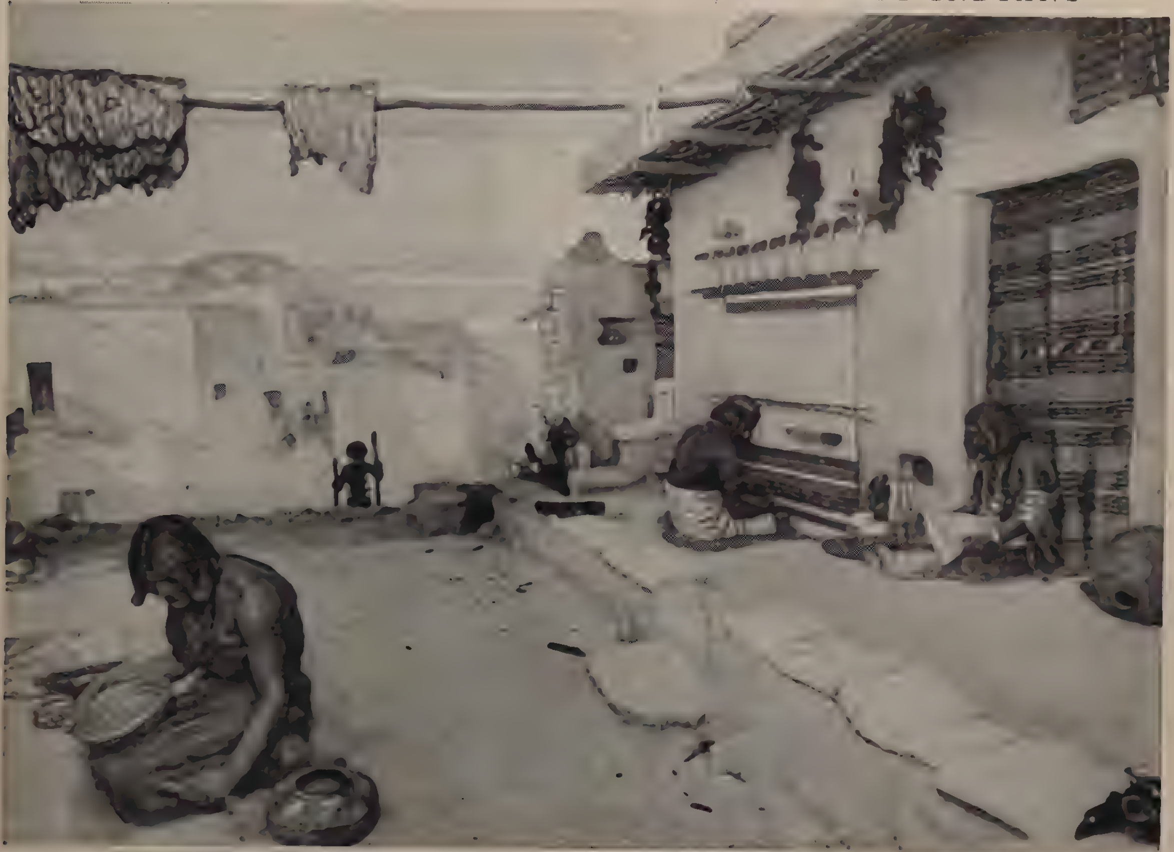
But the women were not mere drudges, at least among the Indians that the Puritans knew. They had a voice in deciding important questions, and among the Iroquois the braves could not go on the warpath without the consent of the women.

The houses were the property of the women, and woe to the brave who did not bring home deer enough to feed the family or to the man who showed himself

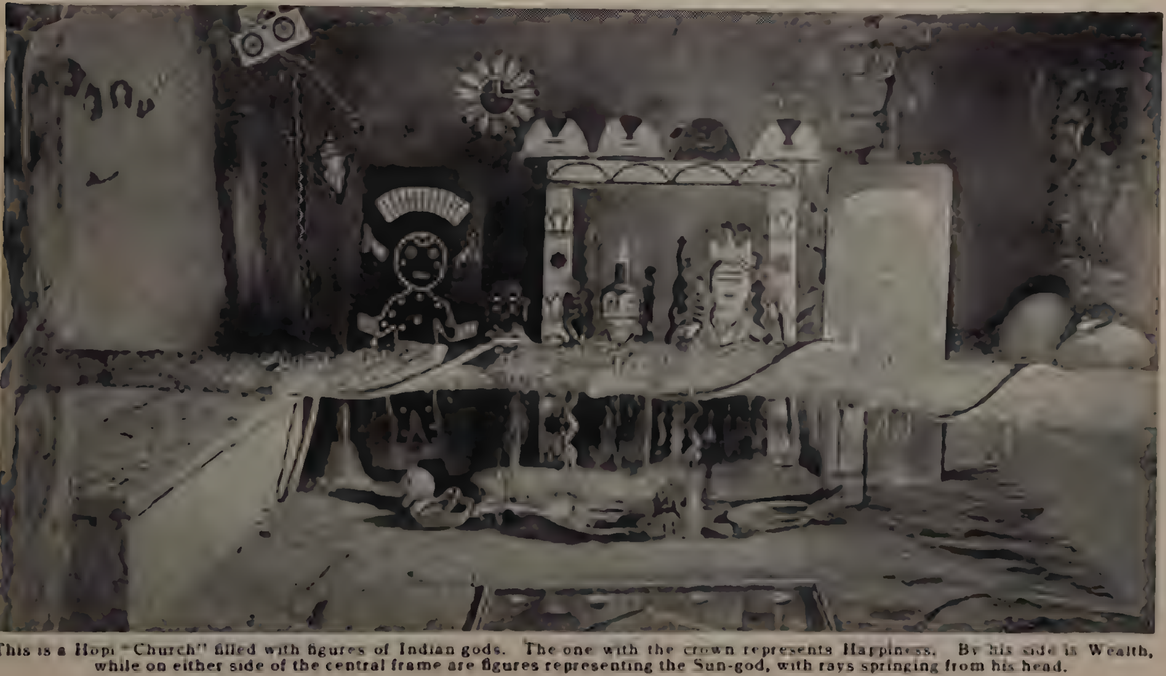
PROPITIATING THE GOD OF THE WATERS

Here a group of Blackfeet Indians are offering prayers to the god who rules the waters of the lake beside which they are seated. Every prominent aspect of nature had a presiding deity, according to Indian belief, and the prayers to each god consisted of fixed ceremonies. These were performed whenever deemed necessary by the medicine men. In this case, the tribe might intend to go fishing, so naturally the favor of the water god is being sought.

INDUSTRY AND RELIGION AMONG THE HOPI INDIANS



At the left a woman is making pottery. In the doorway at the right, a mother is rocking her baby in a curious cradle held on her feet and knees, while next to her a blanket-maker is at work. The old man in the distance is spinning.



This is a Hopi "Church" filled with figures of Indian gods. The one with the crown represents Happiness. By his side is Wealth, while on either side of the central frame are figures representing the Sun-god, with rays springing from his head.

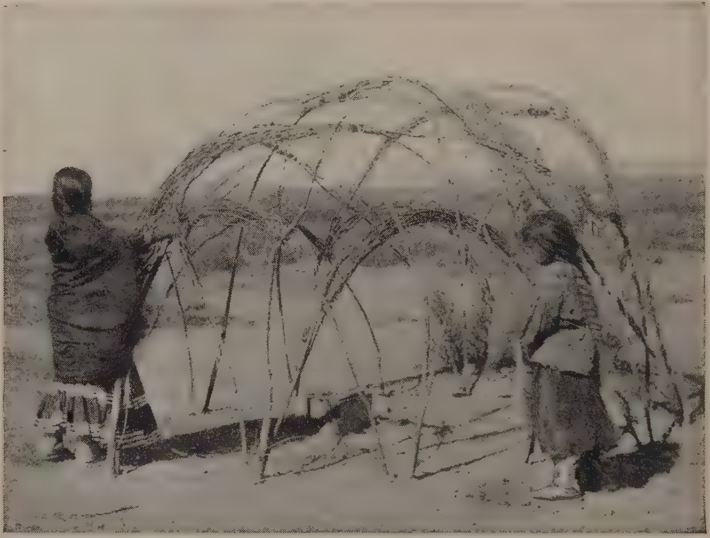
a coward on the warpath. He was apt to be told by his squaw that there was no room for him in her wigwam, that he had better go back to his mother.

And that brings us to the work of the man. He must hunt and make war. But hunting was not done for amusement. It was to get something for the family to eat, for most of the food was gained by hunting and fishing.

There was one form of work, however, of which the Indian brave never seemed to tire—that was war. There probably was never a time when numerous conflicts were not taking place in some parts of the continent. The redmen went to war if another tribe encroached upon their hunting grounds, or if a member of their tribe had been killed by a band from another tribe, or sometimes apparently only for excitement. A brave, wishing to distinguish himself, and perhaps to win the favor of some Indian beauty, would announce that he was going against an enemy and ask others to join him, and so the conflict would begin. However it arose, Indian warfare was carried on with all the cunning and cruelty of which the Indians were capable. If possible they fell upon the enemy unawares and massacred men, women, and children, each brave anxious to take as many scalps as possible. Or they might take a few prisoners back to their village to torture with fiendish delight. Occasionally, however, a few boys or young men were adopted into the tribe to take the place of fallen sons or brothers or husbands.

Because his enemy tried to slip up on him, the Indian fortified his village. The Indians that the Puritans knew lived in villages of wooden huts for at least a part of the year. The Iroquois lived in long wooden or bark houses with a passageway down the middle. These houses were from 50 to 100 feet in length and not more than 15 feet wide. There was no window but there was a doorway at each end, blankets or skins serving as doors. On each side of the passageway were rooms or rather stalls divided by partitions of skins. In each of these rooms a family lived. In the passage were fire-pits, one for each four families.

ARCHITECTURE OF THE HUNTING TRIBES



While the Hopis built substantial villages of mud and stone, the wandering hunters, such as the Apaches, were content with simple houses like the one this squaw and her daughter are putting up. These arched branches will be covered with skins or canvas, and then the dwelling is ready.

The houses of the Algonquian tribes were smaller than the Iroquois homes, and around a whole group of them was a high stockade. There was little furniture in the house. Some skins or blankets served as beds; there were no tables or chairs or stoves.

But whether large or small, all of these houses were so full of smoke and so dirty that it must have been a welcome relief in the summer to live in the more open wigwams. These were simply constructed, of poles fastened together at the top, with skins or matting made of rushes spread over the poles. It was in a tepee made like this and covered with buffalo skins that the Plains Indians lived all the time; and as the eastern Indians were pushed back from their old homes they, too, adopted this as their regular way of living.

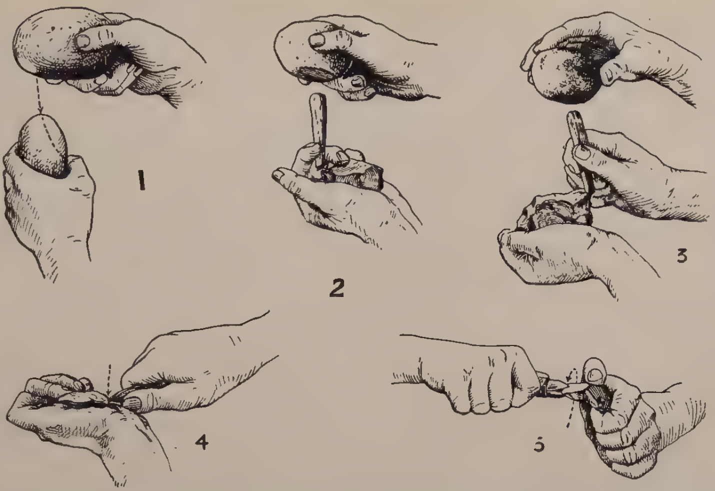
But though the homes were dirty ones, they were not unhappy ones. All listened eagerly to the tales of the story-tellers. They delighted in all sorts of games of chance, for the Indians were born gamblers. And whether winning or losing they never lost their good nature, but laughed just as heartily when beaten as when victorious.

The boys had their ball games; they flew their kites of fish bladders, spun their teetotums, played at tag, hide-and-seek, and blind man's buff. The girls, though brought up to work long and hard, still enjoyed their strange-looking dolls in such leisure hours as they had. And both boys and girls were fond of making mud pies.

Their clothes were made from skins dressed until they were very soft. For trimming dyed porcupine quills, beads, and buckskin fringes were used. Boys' and men's clothes were trimmed as much as women's. Down the side of their leggings ran buckskin fringes. Beads adorned their soft deerskin moccasins and their buckskin jackets or shirt, and around their necks were necklaces of elk teeth, badger claws, or bear claws. The women's short full skirts and jackets were also of buckskin and fringed about the bottom. And the blankets which the men wore were usually made of soft tanned animal hides.

The dances in which the Indians engaged usually were not for amusement, but were a religious ceremonial, or for some magical purpose. The war dance, in which the men were painted as if for war, was intended to influence them in war. The scalp dance was in celebration of victory. The buffalo dance of the Plains Indians was to compel the coming of herds of that animal. The sun dance followed several days of fasting and prayer, and the snake dance was but a small part of a nine days' ceremonial.

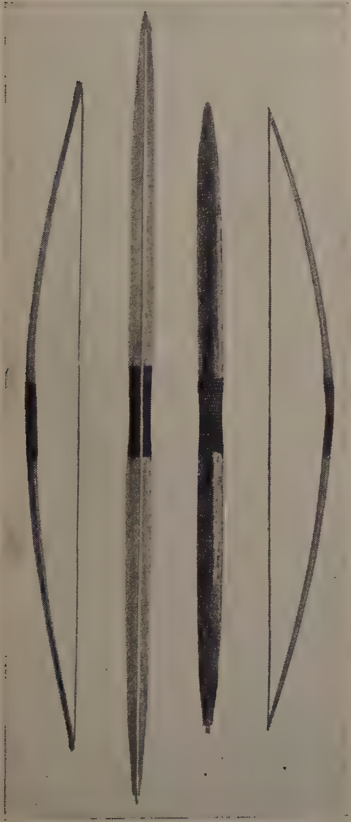
MAKING ARROW HEADS OF STONE



Before the white man came, the Indians of North America made their Arrow Heads as here illustrated: 1, shaping a stone by hammering it with another stone; 2, fashioning finer work with the aid of a stone "chisel"; 3, a more delicate task requiring the aid of an assistant; 4 and 5, finishing the edges by chipping and flaking away the rough places with "pliers" made of bone.

The Indian had very complicated religious observances. Besides the Great Spirit, he believed in many other spirits, some good and some bad. The spirits were all about him, in plants and trees and rustling leaves; they were in the wind and cloud and rain; they were in the mountain and in the brook. It was spirits that caused trouble, suffering, and death. When a man was ill some bad spirit had entered into him.

INDIAN BOWS

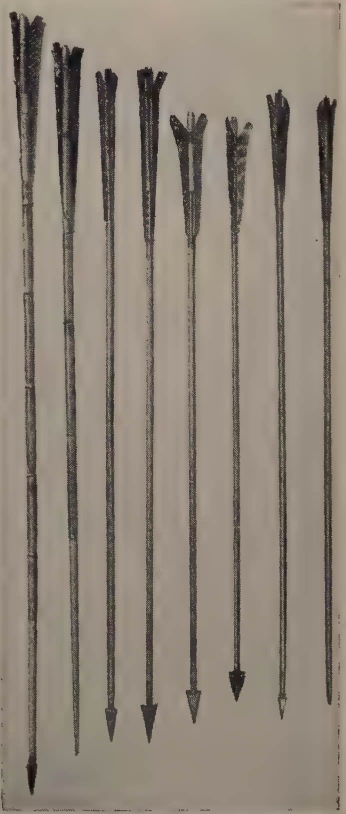


1, hickory bow, a strong-shooting bow; 2, ash bow; 3, yew bow, backed with tendon; 4, yew bow, rawhide back.

And so the Indian had his medicine-men who knew how to gain power over these spirits and drive them away. By muttering magic words, by tricks, and by screaming and making a loud voice, these medicine-men were supposed to overcome the evil spirit. But the palefaces found that the medicine-men knew, too, the healing qualities of many herbs and roots which they used along with their charm.

Such were the Indians that the white men found in the American colonies. But contact with the whites did not improve the savage Indian. At first he regarded the paleface with awe, thinking he descended from the "Great White Manitou" or spirit. When he discovered that the white man was no supernatural being, he welcomed him as a brother. For a few glass beads, some bright red cloth, or other trifle which took his eye, he was willing to share his fields with his paleface brother. He was accustomed to sharing things, for the possessions of the Indians are common property of the tribe or family. When he found that this paleface brother intended to keep the land for his own use, and shut the Indian out of his hunting ground, he became angry. Instead of being a brother he became an enemy. Even when the white man was friendly the Indian was suspicious. As he was driven farther and farther back into the continent, and as he saw that the white people had come to stay, he became more and more bitter. By the time the

INDIAN ARROWS



These are various types of arrows used by the Yahi Indians of California, who also made the bows shown on the left.

whites came to Kentucky and other central states, the Indian was so hostile and the conflicts between the two races had become so deadly that Kentucky was known as the "dark and bloody ground." Daniel Boone could not have lived there if he had not been a renowned Indian fighter.

This hostility of the redmen was played upon by English, French, and Spanish in their contests for territory. Each side used the Indian to murder its enemies and burn their homes. One of the grievances of the Americans at the time of the War of 1812 was that the English incited the Indians against the western settlers. They paid their allies in trinkets, guns, and ammunition, and in fire-water. The last was the most effective, for if an Indian was a dread foe when he was sober, he was doubly to be feared when drunk. There was nothing that he would not do when in that condition. That is the reason that the United States made it a crime to take whisky or other alcoholic liquors into an Indian reservation.

INDIANS PLAYING BALL ON THE ICE

Writers of Indian tales have often pictured the redmen as solemn dignified persons who didn't seem to get much fun out of life, except when burning a village or taking a scalp. The truth of the matter is that among themselves the Indians, when not engaged in warfare, were happy laughter-loving people. This old drawing shows a group of braves playing the game from which modern lacrosse originated. It could be played on land or on the ice. A round stone served for a ball and was caught up and thrown with these crook-ended sticks. Thongs woven across the crook made a sort of pocket. The players divided into two teams, and the object was to throw the ball through the opponents' goal.

Some Famous Indian Wars

The earliest notable conflict with the Indians in New England was the Pequot War of 1637–38. This was soon ended by one bold stroke of the English settlers, who carried the Pequot camp by storm and massacred its inhabitants. In 1675 the very existence of Plymouth was threatened by King Philip's War, when the coast Indians formed a great confederation to drive the whites from the continent. For two years, until the death of their leader, "King Philip," in 1676, there were frightful scenes of massacre and the burning of whites alive in many places.

Numerous conflicts occurred from 1689 to 1763, in which the English, aided by the Iroquois, fought the French and the Algonquian Indians (*see* French and Indian War). After the overthrow of the French in America the daring Ottawa chief Pontiac, angered because his allies had surrendered the Mississippi Valley region to the English, organized an attack on all the 14 British garrisons and settlements in the West. He had earlier led his people at the time of Braddock's defeat (1755), and cherished an abiding hatred for "those dogs in red." In many places the Indians were successful, but at Detroit, where Pontiac commanded in person, they were forced after five months to raise the siege (October 1763). In 1765 Pontiac concluded a treaty of peace with the English, and in 1769 he was murdered at Cahokia, Ill., by an Illinois Indian. He is regarded as one of the greatest of the American Indians.

During the American Revolution the Indians, with the exception of a few tribes, took the part of England against the colonists, largely because of the old alliance with the Iroquois. Immediately preceding the War of 1812 occurred the formidable movement organized by Tecumseh, which was frustrated by the battle of Tippecanoe, on Nov. 11, 1811 (*see* Tecumseh). Other Indians besides Tecumseh's followers aided the British in the War of 1812. In the South occurred the uprising of the powerful Creek Indian confederacy, whose tribes held a large part of Georgia and Alabama. Fort Mimms on the Alabama River was captured by them and 400 men, women, and children massacred (Aug. 30, 1813). United States troops, however, defeated them in numerous engagements, and Gen. Andrew Jackson finally crushed them at Horseshoe Bend (March 29, 1814). More than 2,000 of their warriors were killed, and their towns burned and their lands ravaged. Later there were troubles growing out of the attempt to remove them to Indian Territory, but in 1836 Gen. Winfield Scott reduced them again to submission. About 25,000 were then removed to the Indian Territory reservations west of the Mississippi.

In 1831 Black Hawk, chief of the Sacs, began the Black Hawk War as a result of disputes over the cession of Indian lands in Illinois. Driven back over the Mississippi River by a force of Illinois militia, he returned in 1832 and renewed his attacks on white

WORK OF THE MEDICINE MEN AMONG THE INDIANS

The top picture shows the ceremony of initiating candidates for the position of medicine man among the Winnebagoes. The medicine men formed a sort of secret society, the older members of which initiated the younger ones in the principles of their art. The candidates, who have fasted for several days, are seated at the far end of the long hut. Each old medicine man then parades about the hut and makes a speech, carrying his medicine bag as he goes. After each one has spoken, the old members of the order mass at one end, advance upon the candidates, and knock them over with the medicine bags. When the candidates are permitted to arise, everyone present joins in a ceremonial feast and dance, and the candidates are then full-fledged medicine men. The lower picture shows a medicine man at work charming away the "spirits" who have brought illness to the patient.

villages. After two decisive defeats, the war was brought to an end by his surrender in August. About the same time (1832) the Seminole Indians in Florida refused to ratify a treaty providing for the removal of their tribe west of the Mississippi. This led to a war which lasted seven years and cost hundreds of lives. In the end the whites were victorious and most of the Seminoles were removed to Indian Territory.

When white settlement advanced beyond the Mississippi the ancient struggle with the aboriginal possessors of the soil was renewed. Between 1860 and 1870 the Apaches terrorized the young territory of Arizona, burning and destroying the towns, and slaughtering about a thousand whites. Sporadic outbreaks continued until the last hostile band under Chief Geronimo surrendered in 1886.

Equally formidable opposition to the white man's advance in the Northwest was offered by the great Sioux chief, Sitting Bull. During the Civil War he led warlike bands to the attack of white settlements in Iowa and Minnesota, but in 1864 he and his people were driven into the country of the Big Horn and Yellowstone rivers. From 1869 to 1876 he was continuously on the warpath, raiding frontier settlements. In the latter year, the attempt of Gen. G. A. Custer with 208 U. S. army troopers to force him to return to his reservation failed, and Custer and his whole force were trapped and massacred. After five years of precarious refuge beyond the Canadian border, Sitting Bull accepted an offer of pardon from Gen. N. A. Miles and returned to United States territory. He steadfastly opposed the cession of further Indian lands to the whites, and when a "Messiah craze" broke out among the Northwestern Indians in 1890, Sitting Bull was placed under arrest. In a struggle which followed, he and his son were both killed. With the passing of Sitting Bull and Geronimo the Indian resistance to the white man's advance practically ended.

The Indians are often spoken of as a "vanishing race." People say that after a time there will be no Indians in America, that they are rapidly disappearing; but this is not true. It is true that for a time the redmen seemed to be decreasing. When the white men first tried to force them to adopt a civilized way of living, many Indians contracted tuberculosis. Many others died of measles and other diseases from which they had not suffered before the coming of the white man. But today the number of Indians in the United States is not decreasing.

Of course, there are not so many Indians now as there were when Columbus first landed in America. It has been estimated that in 1492 there were about 1,115,000 redmen in the United States and Canada. Even now there are more than 350,000 Indians in the United States and Alaska, and this is an increase over the numbers shown in previous censuses. It is estimated that in Canada there are about 115,000. Together there are more than 300 tribes.

Of course, not all of these Indians are pure-blooded. Many Indians have intermarried with the whites. This is especially true in Canada, where from the earliest days the French mixed with the Indians, just as in Mexico and South America the Spanish intermarried with the native race. In spite of the well-known example of John Rolfe and Pocahontas, not many of the English settlers married Indians. But today you find descendants of mixed blood from later marriages on the Indian reservations.

The United States government for many years followed the policy of concentrating the Indians on reservations under the control of the Commissioner of Indian Affairs, an official in the Department of the Interior. The largest of these reservations was Indian Territory, now a part of Oklahoma, and many other reservations dot the western states.

On these reservations the Indians lived in tribes just as they had long ago, and their relations to the United States were determined by treaties between the tribe and the nation. They were in fact a state within a state. But in 1887 Congress passed a law designed to release the Indians as soon as possible from government supervision and make them citizens of the United States. Those who wished were to be allowed to take up individual holdings of reservation lands and thereby acquire citizenship. Thousands of Indians avail themselves of this privilege every year. Many day schools and boarding schools for the youth are maintained by the government both on reservations and elsewhere.

The picturesque Indian has disappeared to a large extent. In this sense the redmen are a "vanishing race." But they have left their traces behind them. Along their forest trails are now built great railways of the country. At the posts where they brought their furs to the early traders large cities have sprung up. And Indian names dot the map of the whole country from Massachusetts to California.

INDIAN ARCHITECTURE AT ITS BEST

Although most tribes contented themselves with shelters made of grass or skins, some were quite advanced. This log house was built by Creek Indians in the latter part of the 18th century, and compared favorably, as you can see, with the homes erected later by the white settlers in the same territory.

LITTLE EAGLE-HEART *and His Sister* LAUGHING-WATER

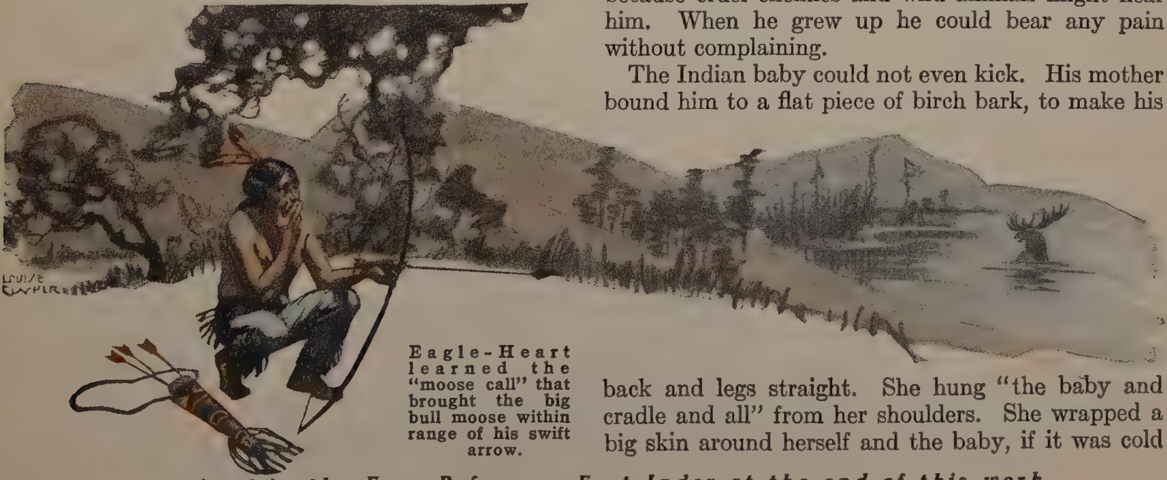
YOU are proud of being an American boy, aren't you? Perhaps you will be surprised to learn that there is another boy who has a better right to the name than you have. He was here more than 400 years ago, when Columbus sailed across the wide ocean and found our country.

This American boy was tall and straight and slender. His eyes were as black as ink, his hair as black as a crow's wing. He could run like a deer, swim like a fish, and climb like a squirrel. He was as solemn as a little owl. When he grew to be a man he wore a head-dress of eagle feathers. His skin was not white, like yours. It was very nearly the color of an English penny or an American one-cent piece. Now you know what he was. He was an American Indian. There are still a great many Indians in our country. Most of them live in houses, or on farms. They dress like white boys, speak English, and go to school. But their faces are the same as those Columbus saw.

It was a hard wild life the Indian boy lived. Still, he had a good deal of fun. It was like camping out all the time. There were about a million Indians here, and the country was so big that there was room for everybody to move about a good deal. There were no cities or farms, no railway trains or wagons, no horses even or cattle. Dogs were their only tamed animals. The Indians had to travel on foot. They followed narrow paths, or trails, through the forests and over the plains. On the rivers and lakes they made long journeys, in boats so light that they could carry them on their shoulders from one stream to another. These boats, called canoes, were made of birch bark stretched over frames of wood. A great many Indians traveled together, for company and for safety. Each band was called a tribe and each had a chief. When a tribe found a good place to camp, the tent poles were stuck in the ground in a circle. The top ends of these poles were tied together. Then the skins of wild animals, or mats woven of rushes, were fastened over the poles. They called this tent a wigwam. Some Indians built dome-shaped wigwams, like tents. Others built long houses of bark, big enough to shelter many persons.

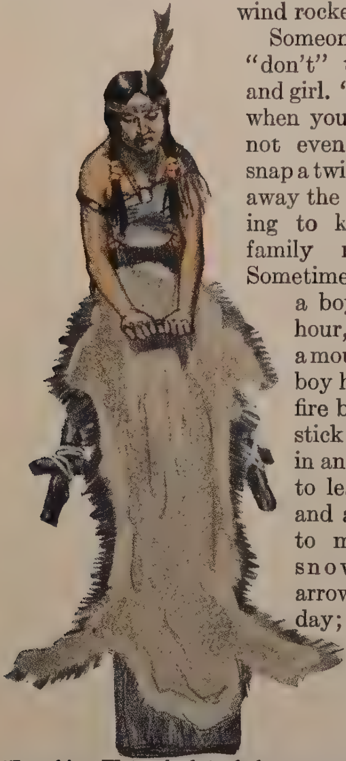
Our little Indian boy was born in a wigwam, in a village of other wigwams in the forest. His mother put a long shirt of soft yellow deerskin on him, and taught him his first lesson before he was a day old. She taught him that he must not cry. When he cried she put her hand over his mouth. She did this because cruel enemies and wild animals might hear him. When he grew up he could bear any pain without complaining.

The Indian baby could not even kick. His mother bound him to a flat piece of birch bark, to make his back and legs straight. She hung "the baby and cradle and all" from her shoulders. She wrapped a big skin around herself and the baby, if it was cold



Eagle-Heart learned the "moose call" that brought the big bull moose within range of his swift arrow.

weather, leaving his face uncovered so he could see. Then they went "by-by." Any baby would like that. When the tribe stopped to rest, the baby and his cradle were hung from the limb of a tree, and the wind rocked him to sleep.


"Laughing-Water had to help scrape the hair from deer-skins with sharp clam shells and rub and pull the skin until it was as soft as a kid glove."

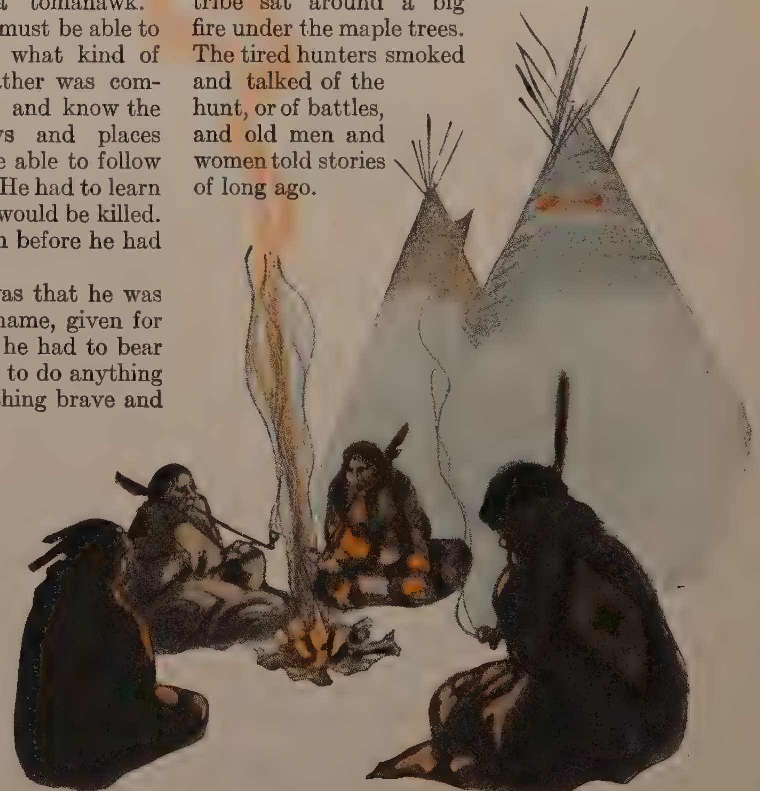
Someone was always saying "don't" to the Indian boy and girl. "Don't make a noise when you walk. You must not even rustle a leaf, or snap a twig." That might scare away the deer father was trying to kill, and then the family must go hungry. Sometimes, when out hunting, a boy had to lie for an hour, as quiet as pussy at a mouse-hole. The Indian boy had to learn to make fire by twisting a pointed stick rapidly in a groove in another stick. He had to learn to make a bow and a stone arrow-head; to make a canoe and snowshoes. He shot arrows at a mark every day; he speared fish, and learned to use a stone hatchet, called a "tomahawk." He must be able to tell what kind of weather was coming, and know the ways and places and calls of animals and birds, and be able to follow the tracks of men and wild beasts. He had to learn how to fight, too, or he and his family would be killed. The Indian boy was grown to a man before he had learned all his lessons.

One sign that he had grown up was that he was given a name. It was really a nickname, given for something he had done. This name he had to bear all his life, so he was very careful not to do anything foolish or cowardly. If he did something brave and got such a name as Eagle-Heart, he was so proud he couldn't sleep the first night. The Indian man was proud and brave and cunning. Sometimes he was cruel. No man could use him for a slave.

If Eagle-Heart's sister was a merry little maid she might be called Laughing-Water. Isn't that a pretty name? Laughing-Water had lessons to learn too. She had to help her mother take the skins from the wild animals the hunters brought home, and cut up and cook the meat. She had to help scrape the hair from deerskins with sharp clam shells, and rub and pull the skin until it was as soft as a kid glove. A needle she made of a fish bone; for thread she used the leg tendons of the deer. Her thread was like our violin strings. It was very strong. Then she sewed the skins into shirts and leggings and moccasins and robes. She embroidered moccasins and belts with little shells, after boring holes through them; and she colored porcupine quills and arranged them in patterns on the soft yellow skin. She colored long eagle feathers and made a warrior head-dress for her father. She made herself necklaces of shells.

In the summer, the Indian women and girls dug holes in the fields, with pointed sticks or clam shells, and planted corn and beans, pumpkins and tobacco. Laughing-Water had to gather the ripe corn, shell it, boil the grains in clay pots, dry them and pound them to meal in wooden bowls. She sifted the meal through a sieve she made of fine tough grass. She wove baskets of reeds and grasses. If she had time she wove colored figures and lines in her pretty baskets. She made clay cooking pots and water jars, and she painted figures on them. One of the nicest things she did was to make candy. She made it by boiling the sweet sap of the maple tree. For her father, Laughing-Water dried the broad tobacco leaves. He put these in a pipe with a stone bowl and a hollow reed stem, and smoked them.

In the evening the whole tribe sat around a big fire under the maple trees. The tired hunters smoked and talked of the hunt, or of battles, and old men and women told stories of long ago.



INDIGO. For centuries the much prized blue dye called indigo was obtained exclusively from the indigo plant, and the indigo trade with India and other centers of production was flourishing and prosperous. Today the natural indigo trade has dwindled to a fraction of its former importance as the result of the discovery of means of making artificial indigo.

The story of artificial indigo is one of the most interesting in the history of chemistry. It took 17 years of tireless experiment and the expenditure of nearly $5,000,000 to perfect the process. As early as 1880 a German chemist, Adolph Baeyer, produced synthetic indigo from coal-tar products, but the cost of production was much greater than that of the natural dye. From then until 1897 he and others worked on the problem of making indigo by less expensive processes, and finally succeeded in producing it at less than half the cost of the plant dye. There is still a steady demand for the natural indigo, however, from manufacturers of textile goods who desire a "fast" blue of certain tints. (*See* Dyes.)

Vegetable indigo is obtained from a shrubby plant three to five feet high, with rounded leaves and pale-red flowers, belonging to the bean family. When three months old and in blossom, the plants are cut down, but soon shoot up again, and yield a second and often a third cutting in one year. The cut stems and leaves are crushed and soaked in water for several hours. Fermentation takes place. Then the water, which is clear yellow, is run off into another vat and stirred. Indigo begins to form in flakes on contact with the air and settles to the bottom. It is filtered through linen, molded into small cakes, and dried.

The best quality comes from Bengal. Indigo plants are also grown in Java, China, Ceylon, Mexico, Brazil, and Central America, and for a time there were extensive plantations in South Carolina and other southern states. Scientific name of Bengal indigo plant, *Indigofera sumatrana*.

INDO-CHINA. "Farther India," or "Indo-China"—the great projection which forms the southeastern corner of Asia—looks on a political map somewhat like a flower with three petals, supported on the slender stem of the Malay Peninsula. The western petal is Burma, an English colony adjoining India; in the center is Siam, which alone of the group retains its ancient independence; and French Indo-China in the east forms the third division. Siam also includes the upper part of the "stem," in the lower portion of which are the Federated Malay States, under the protection of Great Britain, and the Straits Settlements, a British colony. (*See* Burma; Malay Peninsula; Siam.)

Lying between India and China, Indo-China has something of the nature of each of these two great countries of southeastern Asia. The people, originally of Chinese stock, have derived their religion and much of their language from the Hindus, and are really a composite of both races. The more primitive Malays, who inhabit the narrow peninsula, have also had their share in creating the complex physical and social characteristics of the Indo-Chinese race.

French Indo-China, with its five provinces, Tonkin, Anam, Cochin China, Laos, and Cambodia, looks out over the China Sea, where the typhoon is born. At least 80 per cent of its 17,000,000 people are Anamese. Shorter than the Chinese and darker, the Anamese has a low forehead, small flat nose, and eyes rarely oblique. He is peace-loving and more industrious than the wilder Lao, who lives in the mountains, but is not so hardworking as the Chinese, who has so largely influenced his written and spoken language, his religion (a rather vague sort of Buddhism mixed with ancestor worship), and his dress—wide trousers, a long black tunic, a colored turban or a wide straw hat, and sandals or bare feet. His house is a one-room affair, with a veranda in front where the altar to his ancestors stands. In the daytime it has only three walls, but at night a bamboo partition let down from the roof shuts out a little of the night dampness of this semi-tropical climate. He grows two crops of rice a year, a little tea and tobacco, mines some gold and tin in the hills; in his forests he gathers saps which give him the pretty colors of his native cloths, tree-fiber from which he makes paper, and herbs and roots which with fish and rice make up most of his daily ration.

The French, who began their conquest in 1787, have not made much change in this picture of the life of the native, except in the capital cities, such as Hanoi (110,000) of Tonkin, Pnompenh (85,000) of Cambodia, Saigon (65,000), of Cochin-China, and Hué (60,000) of Anam, and the large cities of Cholon (191,000) and Binh-Dinh (75,000). Cambodia became a French protectorate in 1863, Tonkin and Anam in 1884, and Laos in 1893. Cochin-China has been a French colony since 1867. In 1887 it was united with the protectorates to form the customs union of French Indo-China. The government is administered by a Governor-General, responsible to Paris, and a Superior Council. Hanoi is the seat of government for the union.

The area of French Indo-China, variously estimated at from 256,000 to 308,000 square miles, is about that of Kansas, Nebraska, and the two Dakotas combined. Its two great rivers are the Red and the Mekong. Its imports, mostly from France and free of duty, are machinery, cotton and silk goods, tobacco, tin, and iron and steel; its chief export is rice and other exports are sugar, fish, pepper, coal, cotton, hides, and rubber. Railway lines carry merchandise between the main centers and are supplemented by trains of pack mules to reach the mountain and back country area.

INDUS RIVER. Glacier-born amid the wind-swept wastes of Tibet, this mighty river of India rushes for the first 500 miles of its 2,000-mile journey through an array of majestic Himalayan peaks of unequaled grandeur. After flowing northwestwardly through Kashmir it bends to the southwest and presently emerges into the great Indian plain of the Punjab, the "land of the five rivers," which the Indus and its tributaries water abundantly.

The united flood of the six rivers now sweeps on through Sind plain—a region which is the creation of the Indus as Egypt is the creation of the Nile. The climate here is almost rainless, but thanks to the annual inundation of the great river, when the melting snows of the Himalayas cause it to burst its banks, and to an intricate network of canals, all this region produces abundant crops of cotton, millet, rice, and wheat. Even the soil is the gift of the river, which carries the fine sand and clay of its upper course to the Sind plain and deposits the silt there as it slackens its impetuous course. So abundant is this accumulation that the Indus has raised its bed 70 feet above the level of the plain at its border 50 miles away.

In the lower part of its course, except where it runs between walls of rock, the river continually shifts its bed, especially in the 130-mile delta, through which it finds outlet to the Indian Ocean by means of a great number of little channels. Hence there is little navigation, except by the high-sterned flat native boats. Fish are abundant and crocodiles and alligators infest the lower reaches. Many bridges cross the river, of all types from modern steel suspension railway bridges to the swaying rope and vine bridges of the mountaineers.

INDUSTRIAL REVOLUTION. Until about 1750 the world carried on its daily work in much the same way that it had done for more than 2,000 years, and a contemporary of Pericles would have had little difficulty in making himself at home in the England of George III. Plows were still clumsy wooden affairs that did little more than scratch the ground; reaping was done by hand with sickles and scythes; jointed sticks called "flails" were used for threshing the grain. The tools of the carpenter, smith, and mason resembled those shown on the old Egyptian monuments; and except for the hand- or foot-driven spinning wheel, spinning and weaving showed little progress since the Homeric days when Penelope wove her web by day and unraveled it again in the secrecy of the night.

We may sum it all up by saying that there were no *machines* before 1750, such as now perform most of man's work for him and place at the disposal of every one goods which only the wealthy could formerly buy. On the other hand there were no smoke-blackened factory towns with their squalor and desolation; and problems of unemployment, of capital and labor were few or unknown. It is to the changes which, within less than a hundred years, wiped out this age-long condition of affairs and brought about the throbbing, pressing, machine age of today, that we give the name Industrial Revolution.

The movement began first in Great Britain and it has gradually spread over the world. In agriculture it came first with better tools and methods of cultivation, particularly the growing of root crops—turnips and beets—in rotation with grain. Breeds of cattle and sheep were improved, and draining and fertilization made the land more productive and capable of supporting a larger population (*see* Agriculture). At the same time roads were improved and canals were built for transporting heavy commodities.

Then about 1750 began the great movement growing out of the new machines for spinning and weaving (*see* Spinning and Weaving). These brought the factory system and the application of water and steam power to manufacturing—with the long train of inventions which have made the steam engine more and more a thing of wonder, until it became the thundering locomotive dragging its train at 60 miles an hour across continents only a few score years removed from savagery. And machine has followed machine, of ever growing wonder and complexity, until now it is calculated that in the textile industries alone the work of these non-human slaves who serve us equals that of 50 billion persons working with the old hand tools!

Production has thus increased enormously, and with it the population of the earth. The whole world has become a single industrial state; cities have grown to gigantic size as compared with the country; the rich have grown richer, but alas! the poor in many cases have become poorer; and education and information have spread broadcast, until a flood of democracy has everywhere crumpled the ramparts of kings.

No period since the world began has seen changes which can begin to compare in importance with these. Is it any wonder, then, that competent historians have called the Industrial Revolution "the greatest single event in the world's history"! (*See* Inventions.)

INITIATIVE, REFERENDUM, AND RECALL. The constitution makers of the early United States distrusted the ability of the people to govern themselves directly, and so introduced a system of checks and balances, and indirect government through elected representative assemblies holding office for a definite period. The acts of Congress and legislatures were subject not only to the veto of the president or governor, but to review by courts appointed generally for life. Times have changed since then, and today the people seek to curb somewhat the authority of their representatives. Three of the modern weapons in the fight to place more direct power in the hands of the people are the initiative, referendum, and recall.

The first two are methods of controlling the law-making body. Your Latin will tell you the meaning of the terms: initiative from *initio*, meaning "begin," and referendum from *refero*, "carry back." The initiative then is the means by which the people may begin making a law, and the referendum the means by which they may act upon a law already passed by the legislature.

Of these two the referendum is the older. It was in use in some of the Swiss cantons as early as the 16th century. When the United States was formed three of the new state constitutions were referred to the people for their approval; and by 1820 the referendum on constitutional questions was generally in use in this country. Some important local matters, such as changing the boundaries of counties, locating county seats, the borrowing of large sums of money, etc., were also submitted to the people of the locality interested, even in colonial times. But it was not until 1898 that the referendum for any law passed by the legislature was authorized by a state in the Union. In that year South Dakota passed such a law and since that year many other states have followed her example. Under the referendum if anyone thinks a law passed by the legislature is bad, he can within a given time sign his name to a petition asking that the law be referred to the people. He then circulates the petition among his fellow-citizens and if a certain number or a certain percentage of the voters affix their names, the question is submitted at an election and the majority of voters decide it by an answer, yes or no.

The referendum led to the initiative both in Switzerland and in the United States. If the people were capable of deciding whether a law passed by their representatives was good or bad, why were they not capable of originating laws which were needed? Oregon under the leadership of William U'Ren, a lawyer and reformer, began the movement in America in 1902 and the "Oregon plan" for the initiative and referendum has been followed by other states. That commonwealth not only gives the people a share in legislation but it also educates the voters by sending out pamphlets containing the laws to be voted on and arguments for and against them. The details of the initiative laws, like those in the referendum, differ in different states. In some the bill is placed on the ballot immediately after the petition is filed. In others it must be submitted to the legislature and then, if that body refuses to act, it may be submitted to the people.

The recall has to do with the control of officials rather than of legislation. It is a method of removing from office before the end of their term men who have proved unsatisfactory. The usual way of accomplishing this is to hold a new election if a certain per cent of the voters ask for the recall of an official. If, in this new election, the old officer receives the highest number of votes he remains in office. If not he is "recalled," or removed, and the man who did have the highest number takes his place. The recall is, as Woodrow Wilson once said, rather "a gun behind the door" with which to threaten officials than a weapon for ordinary use.

INK. If the ink runs smooth and free from your pen, sinks into the paper without spreading, and leaves a blue-black mark that becomes deeper and deeper in color, even if it is exposed to the sun's rays, it is probable that it was made of nut-galls, from which, for centuries past, the best grades of ink have been made.

The nut-galls used are growths of a species of oak found in Asia Minor. The gall-fly, a small wasplike insect, burrows into the soft twigs and deposits her eggs. The tree throws protective tissues over the spot until a lump sometimes nearly an inch in diameter, is formed. These lumps, or nut-galls, contain a large amount of tannin, the substance which makes them so valuable for ink making.

Solutions of the nut-galls and an iron salt, usually green vitriol, are mixed, and a chemical change occurs, forming the color. A thickening substance, often mucilage (gum senegal), holds this color suspended in solution. Small quantities of various acids keep the ink from coagulating and molding. Often other coloring agents are added to make the writing darker in color at first.

If you are using an inferior grade of ink, it may have been made of logwood from the West Indies, or by mixing green vitriol with other tannin solutions. Such inks, while they may be satisfactory at first, fade out after a few years. Some ancient documents written with ink made of nut-galls are as bright and clear today as when they were written, centuries ago; while inferior ink fades in a few years.

How Fountain Pen Ink is Made

If you are writing with a fountain pen, the ink you are using was made probably from the black aniline dye, nigrosin. This makes a brilliant blue line, and because it never thickens and no sediment forms, it is peculiarly adapted to the fountain pen, although the color is not so permanent. All colors of ink can be made with aniline dyes.

Red ink is sometimes colored with the powdered bodies of thousands of tiny red insects, called cochineal, brushed from the cactus in Mexico, Central America, and Peru. Other red inks are made from brazilwood, imported from Central and South America; while not producing such a brilliant scarlet as cochineal, these inks do not fade so quickly.

Then there are the secret or "sympathetic" inks, which leave no visible mark on the paper when they are used. Many important papers have slipped past an enemy's eyes by this means, to reveal their messages when they have reached their destinations. Some of the favorite secret inks are lead acetate solution, whose invisible marks turn black upon exposure to sulphureted hydrogen; cobalt nitrate solution, which turns blue when it is treated with oxalic acid; and cobalt chloride or nitrochloride, which becomes green when heated. During the Indian Mutiny letters and orders were sometimes written with rice water, to be developed later with iodine. A clean pen dipped in lemon juice will produce writing which is invisible when dry, but which stands out sharply in brown when the paper is heated.

"India Ink" from the Orient

Artists use India ink. This is an early form of ink invented in China 1200 years before the Christian era, and the best qualities are still made in China and Japan. Lampblack, made from sesamum oil, is mixed into a paste with a glue made from asses' or oxen's skins, and then pressed into sticks or molds.

The most interesting ink of all, perhaps, is sepia, obtained from the cuttlefish or squid. This most uncanny of sea creatures has on the under side of its body a gland containing a deep brown fluid, which it can throw out at will to conceal its escape when it is alarmed. Sepia ink, the most lasting of natural inks, is made from this fluid.

Copying inks are ordinary inks made with less water and a larger amount of pigment and a substance (gum arabic, glycerin, etc.) which will retard the oxidizing effect of the air. Printing inks are quite unlike writing inks, for they are gummy, adhesive substances. In the "fountains" of the printing presses this ink looks like heavy black or colored pitch, and the oils contained in it give it a distinctive though pleasant smell. A good printing ink must fulfill many requirements. It must distribute freely over the roller, spread sharp and clear over the type, and come off easily from the type to the paper. The best printing inks are mixtures of carbon black or gas black and linseed oil, although with the increasing cost of linseed oil some form of rosin oil is generally used as well. Common soap is also an ingredient. Gas black is made by burning gas flames in a scanty supply of air. The flames are thrown against metal slabs or into revolving cylinders, and the soot that accumulates is scraped off and ground.

Inks were used by the Egyptians and the Chinese more than 2,500 years B. C. While the exact character of these inks is not known, they were probably simple mixtures of powdered charcoal and glue. The Romans used sepia as a writing fluid. Iron-gall inks, however, seem to have been first compounded about the 11th century. From that time forward these inks gradually replaced other inks. In those early days they were usually mixed by the writers themselves, and recipes for their preparation were circulated between households, much as cooking recipes are exchanged today. The scientific preparation of standard writing fluids did not begin until the middle of the 18th century.

INNOCENT, Popes. Of the 13 popes who have borne this name INNOCENT I was in office from 402 to 417, and is chiefly remembered because of Alaric's sack of Rome, in 410. But he was an able and energetic pontiff and lost no opportunity of asserting the papal power. INNOCENT II (Pope, 1130–1143) condemned the great scholar Abelard as a heretic.

INNOCENT III (Pope, 1198–1216) was in many respects the ablest and most powerful pope of the Middle Ages. His lofty and severe character inspired universal respect. He greatly strengthened the temporal power of the papacy, for in addition to the Papal States, which he ruled in Italy, he had as vassal states under him Sicily and Naples, Sweden, Denmark, Portugal, Aragon, and Poland. It was to him that King John surrendered England, receiving it back from the pope's legate as a fief. He also put in practice the papal claim to set up and pull down emperors of the Holy Roman Empire, in the case of Philip of Swabia and Otto IV. While he was pope occurred the Fourth Crusade and the Latin conquest of Constantinople.

INNOCENT VII (1404–1406) was one of the Popes during the Great Schism of the Church. Under INNOCENT VIII (1484–1492) corruption reigned at Rome. INNOCENT X (1644–1655), INNOCENT XI (1676–1689), and INNOCENT XII (1691–1700) were all reforming popes, who combated heresy and sought to improve the Roman administration. The others require no separate mention.

INQUISITION. To check the waves of heresy that swept over Europe in the 13th century, the Church of Rome established a special tribunal called the Inquisition to try persons accused of revolting against religious authority. Up to that time heresy trials had been conducted by the local bishops. The new Inquisition courts, which soon were put in the hands of the Dominican friars, were able to carry forward the work on a broader scale.

Arriving in a district, the judges, aided by the local bishop and the state authorities, would announce 30 days' grace for all heretics to come in and confess their crime. When that period was up the trial of the accused and unrepentant ones began. The names of witnesses were kept secret, but the defendant was permitted to submit a list of enemies, and none of these might appear against him. Following the frequent practice of the period in criminal trials, torture was often used to force confessions of guilt.

At a grand ceremonial, called *sermo generalis* or *auto-da-fé*, the names of the guilty were announced and punishments inflicted, ranging from fines and excommunication to imprisonment for life or burning at the stake for incorrigible heretics. Since canon law forbade the clergy to participate in bloodshed, the severer penalties were carried out by the state.

The Inquisition reached its height in Spain during the days of King Ferdinand and Queen Isabella, when Fray Tomás de Torquemada (1420–1498) was made inquisitor general for the kingdom. Here the crown exercised almost complete control over the Inquisition and carried it to extremes, often coming in conflict with the authorities at Rome.

The Inquisition was sometimes used as a cloak for political and private revenge, and at times the sincerest inquisitors were misled by fanatical zeal and practiced great cruelties. But on the whole, the institution was a logical product of its time. In those days the church and state were united in the closest bonds, and heresy was considered a crime against both, to be compared only with high treason and anarchy. To the people of the period it seemed as reasonable to punish a man who "plotted against the life of the church," as it would in our day to punish a man who plotted against the existing government.

The Inquisition was chiefly active in southern Europe, and continued in modified form in Spain until 1820. The Congregation of the Holy Office, established by Pope Paul III in 1542 to review the judgments of the Inquisition courts, still exists. It examines charges of heresy, but imposes only spiritual punishments such as excommunication.

The SIX-LEGGED CREATURES *of* AIR, LAND, *and* WATER

HERE you will read the story of the eternal warfare going on around us between the countless millions of the insect world. You will learn how they get their food, fight their battles, and protect their young, and also something about the magic that puts wings on the caterpillar, and turns the helpless grub into the busy bee.

INSECTS. When you open the gates of insect land, the first thing to startle you is the amazing number of the inhabitants. If you could count all the men in the world, all the four-footed animals, all the birds, all the fish in the rivers and oceans, the total would be small and insignificant compared to the number of insects.

If you could put all the insects on one side of a huge scale, and all remaining land animals, including men, on the other, the insects, small as each of them is, would weigh down the scale.

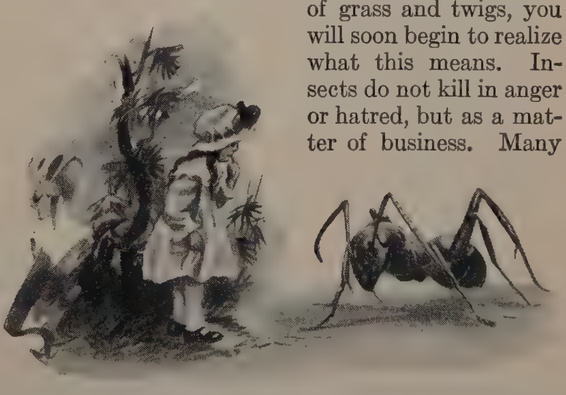
Whenever men have tried, for any reason, to calculate insects by numbers, they have reached sums so staggering that the human mind fails to grasp them. For instance, on the island of Cyprus in the Mediterranean, during a fight against the locust plague, 1300 tons of locust eggs were destroyed in one year. Yet the next year it was estimated that the locusts which survived laid, on that island alone, 4,000 tons of eggs—making the enormous total of 100 billion individual eggs. And yet these figures represent only one particular species of insect in one tiny corner of the earth. And there are in the world at least one million different species of insects.

Everywhere that there is life these six-legged creatures thrive and multiply—flying, creeping, burrowing. Most people pay little attention to them, except when they are bitten or otherwise bothered by some of the bolder members. Yet insect habits and history are stranger than the weirdest tales of fairyland.

Imagine yourself a pigmy one inch high pushing out into the insect world to learn their customs at close range. You would need to have, of course, some magic password to insure your safety, or you would be killed within an hour. You would learn as your first lesson that in insect land "might is right." Death lurks at every corner. Each hole in the ground or hollow beneath a stone may hide some nightmare monster with yawning jaws waiting for his prey. A dead leaf may conceal a hungry dragon who will pounce upon you as you pass. Or some flying creature may swoop down out of the air to deliver the fatal blow. Murderous warfare goes on night and day on all sides.

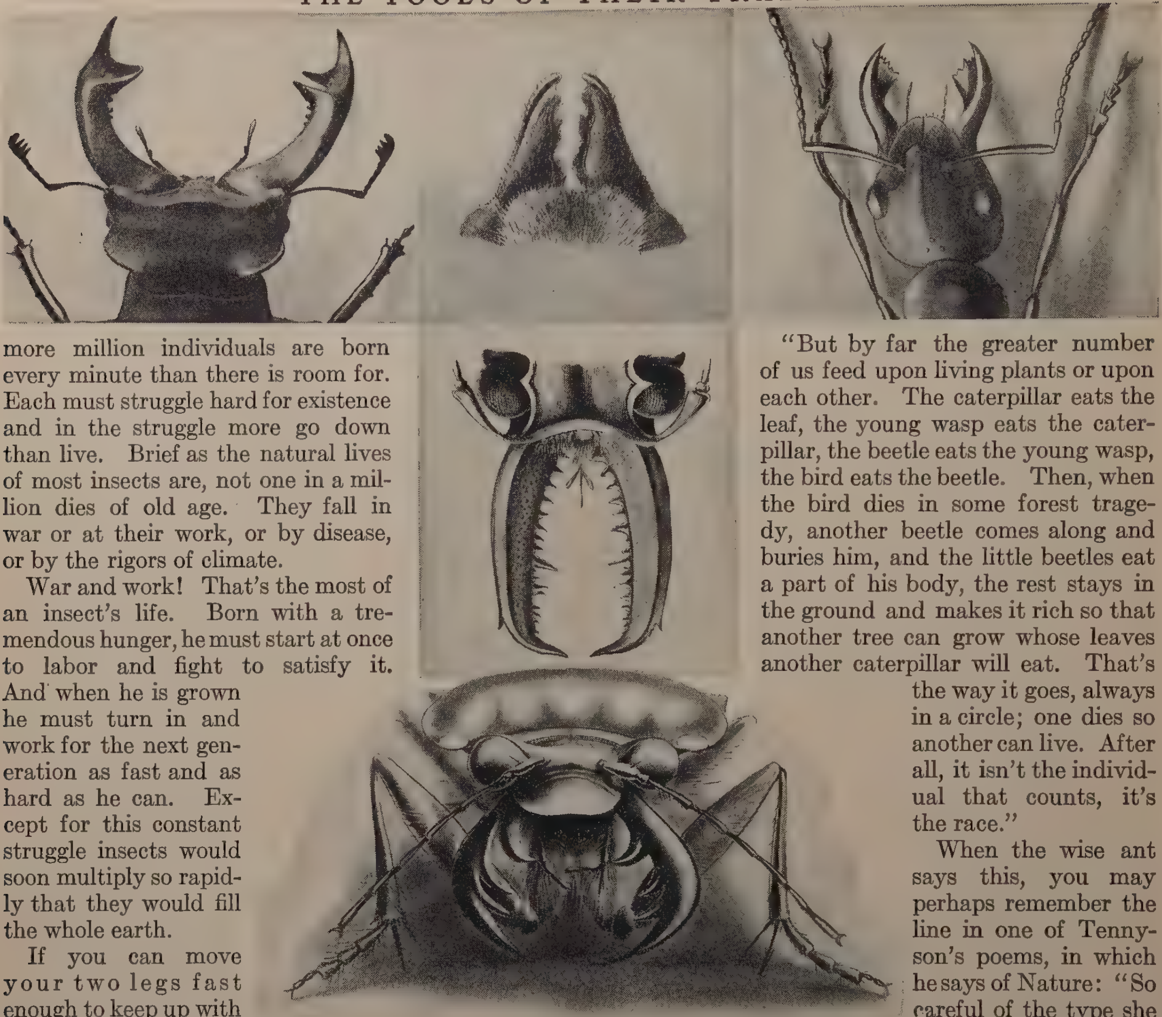
Perhaps some wise old ant hurrying by will tell you the answer to this tragic riddle: "To eat without being eaten is the first law of insect land. And the second law is to lay eggs and provide for the young. There are no other laws but these."

As you pick your way forward through the jungle of grass and twigs, you will soon begin to realize what this means. Insects do not kill in anger or hatred, but as a matter of business. Many



"To eat without being eaten is the first law of insect land. And the second law is to lay eggs and provide for the young. There are no other laws but these."

THE TOOLS OF THEIR TRADES



Like human workmen the busy little people of the insect world have different tools for different purposes. The first picture on the left at the top shows, much magnified, the mandibles of the Stag Beetle. Next are the "scissors" with which the Leaf Cutter Bee does such neat work. On the right are the powerful pincers with which the Wood Ant fights and works. The central picture shows the saws of the Sawyer Beetle, while below we see the picturesque countenance and the hungry jaws of the Green Tiger Beetle.

more million individuals are born every minute than there is room for. Each must struggle hard for existence and in the struggle more go down than live. Brief as the natural lives of most insects are, not one in a million dies of old age. They fall in war or at their work, or by disease, or by the rigors of climate.

War and work! That's the most of an insect's life. Born with a tremendous hunger, he must start at once to labor and fight to satisfy it. And when he is grown he must turn in and work for the next generation as fast and as hard as he can. Except for this constant struggle insects would soon multiply so rapidly that they would fill the whole earth.

If you can move your two legs fast enough to keep up with the six legs of the ant, you may learn, as you travel together more about the strange customs and history of its fellow insects.

"Always remember," the ant will say, "that in our land everything can be traced back to those two laws. All the shapes and colors of insects, that seem so horrible or beautiful to you, are not accidents. They all mean something in our struggle to live.

"Since there are so many of us, we have had to learn to eat almost anything in the world. Anything that's alive, or has ever been alive, is food for one kind of insect or another. There are some even that live on wooden furniture, old shoes, and the paper in books —they've learned to do that since you men started making such things. Others, such as fleas, mosquitoes, and certain flies, feed on living men and animals. Still others clean up dead vegetable and animal matter they find lying around.

"But by far the greater number of us feed upon living plants or upon each other. The caterpillar eats the leaf, the young wasp eats the caterpillar, the beetle eats the young wasp, the bird eats the beetle. Then, when the bird dies in some forest tragedy, another beetle comes along and buries him, and the little beetles eat a part of his body, the rest stays in the ground and makes it rich so that another tree can grow whose leaves another caterpillar will eat. That's the way it goes, always in a circle; one dies so another can live. After all, it isn't the individual that counts, it's the race."

When the wise ant says this, you may perhaps remember the line in one of Tennyson's poems, in which he says of Nature: "So careful of the type she seems, so careless of the single life." The ant continues:

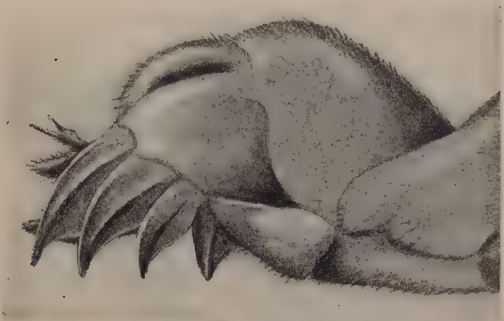
"The character of an insect's mouth-parts depends on what he eats. Some have strong jaws to tear leaves or bite the bark of trees or gnaw each other. Some have a sucking apparatus to draw in honey or fruit juices. Some have tiny pointed beaks to pierce the skin of plants or of animals whose blood they drink. Indeed, the mechanisms with which insects get their food are much superior to men's mouths.

"The manner of our life also influences our feet and legs. Some of us have sharp claws for climbing or clinging to the bottom of a leaf, while others have sucker-like hairs on their feet for hanging upside-down on smooth surfaces. Others still have broad flat feet for digging, or huge front legs with great talons for seizing and holding living prey, like that great hypocrite, the praying mantis."

THE CYCLE OF LIFE AND DEATH IN THE FOREST

"The caterpillar eats the leaf, the young wasp eats the caterpillar, the beetle eats the young wasp, the bird eats the beetle. Then, when the bird dies in some forest tragedy, another beetle comes along and buries him, and his remains make the ground rich so that another tree can grow whose leaves another caterpillar will eat."

Here the old ant stops and holds up its own front feet. "I'm a runner and a climber too, you see. I'm made for work. But my queen," it says, bowing its head at the name, "has wings and can fly like the great majority of insects."



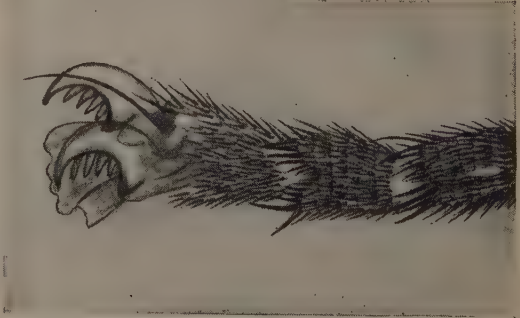
INSECT STYLES IN FOOTWEAR

The Mole Cricket is the greatest digger for his size in the world. Look at his front foot and you'll see why. With those powerful claws he cuts and scrapes through the earth, scooping it back with that strong broad "palm." That slit at the top of the foot is the Mole Cricket's ear.

"All insect tribes that are alive today," it continues, "have survived because they have some special tricks for avoiding destruction. And these tricks all follow one or more of four systems—numbers, concealment, armor and weapons, and what we may call 'frightfulness', which is another name for bluff.

"The number system is simple. It consists in laying eggs and bringing up children faster than all our enemies put together can eat up. This method is used more or less by all insects, but particularly by such helpless creatures as the scale insects. Fruit growers have found how hard it is to kill these off. You can destroy ten millions of them, but if one escapes, there'll be millions more born inside of a month.

"The concealment method is far more clever. Some insects are positive geniuses at it. The leaf-insect imitates the color and shape of a leaf so skilfully that his own brothers, who are strictly vegetarians, sometimes bite him by mistake. There's a butterfly also that does the same thing, imitating even the stem which attaches the leaf to the twig. This is what you now call 'camouflage'—but it's a very ancient science among insects. Some of us imitate a stick of wood, or the bark of a tree, or a flower blossom. The system works best of all in fooling our two-legged enemies—birds and men—who look for us from a distance.



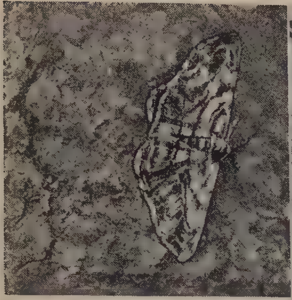
Just below the Mole Cricket's foot we see the stag beetle's double claw. The third picture shows the foot of the Ditch Skater that flits over the water of ponds and ditches. The hook is for holding to water plants or to its prey. A fourth picture shows the foot of the Scorpion Fly, which has long spiny legs and grasping claws for clinging tight to its victim.

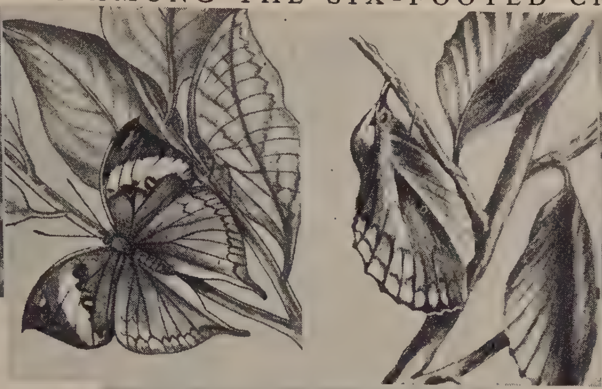
"But what will interest you most is the armor and weapons we use in protecting ourselves against our enemies. Just feel my back a second," says the ant, stopping short. "Do you see how tough, and smooth, and springy it is? And the top of my head, too, is covered with the same kind of tough, horny skin. That's made of stuff you call *chitin*. Every insect has more or less of it on his body. The beetles are particularly well protected by it. With many of them it amounts to a solid shell of armor that will turn the sharpest pair of jaws in insect land. The only places on a beetle where I ever could get a hold were at his knees and elbows, or in the soft joints of his stomach. Some beetles can draw their heads and legs close in and laugh at any small bird that tries to pick through their thick shells. Besides protecting us, this chitin covering takes the place of a bone skeleton, such as you have, and helps us to hold our shape.

"As for our weapons, our jaws, of course, are very effective against enemies who are near our own size. For larger foes, insects have a wide assortment of sharp beaks and poison stings, with which they can inflict painful wounds on the biggest of creatures. The wasps and the bees are the best all-around single-handed fighters. But when it comes to organized warfare, with army formations, massed attack or defense, and all the details of strategy and tactics, together with patriotic courage, the reputation of the ant family speaks for itself." There is a certain note of pride in the old ant's voice as it says this.

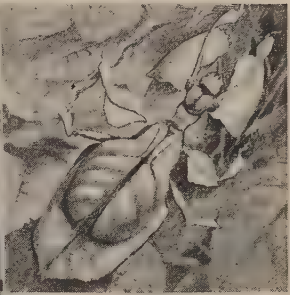
"The real joke, though," the ant continues, "is the way insect frightfulness or bluff works. You know how the common earwig frightens you men when he

CAMOUFLAGE AMONG THE SIX-FOOTED CREATURES





First, a Willow Beauty Moth blending with the bark of a willow tree. Next, two Indian Leaf Butterflies, one with wings open, the other folded.



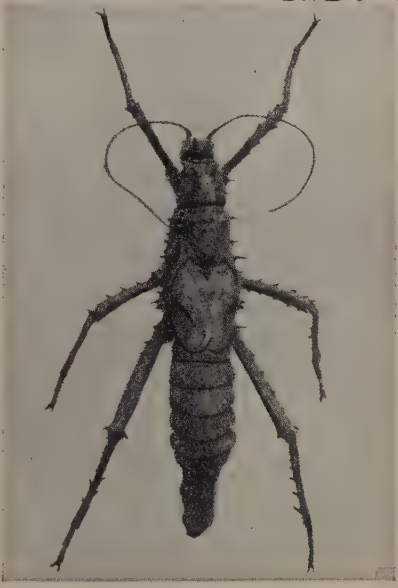
Third, a Lappet Moth, another leaf imitator. Last, a Walking Leaf Insect, probably the best mimic of all. He even fools his relatives.

curls up that terrible-looking tail of his with its snapping pincers? That's bluff, pure and simple. He couldn't possibly hurt anything with that, yet many an earwig owes his life to the terror he inspires.

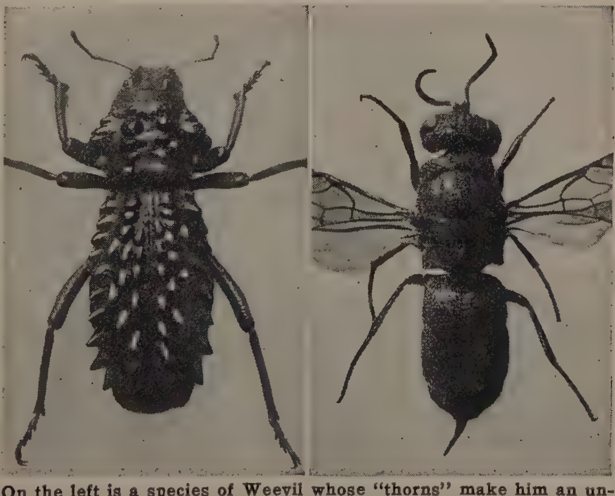
"The stag beetle and the rhinoceros beetle look so fierce with their huge horns that they scare other insects and even birds away. But if you should put your finger between the stag beetle's big pincers, he wouldn't know what to do. He certainly can't pinch hard enough to do any harm. There are dozens of examples of such frightfulness. Some harmless insects even imitate the shape and color of the stinging kind and so escape. Certain flies, for instance, mimic bees.

"Did you ever hear of the bombardier beetle? He's the real inventor of the poison-gas artillery. When a larger beetle or a bird pursues him, he fires a little cannon he carries on his tail. It goes off with a 'pop' and forms a little cloud of blinding gas, which covers his escape. The puss-moth caterpillar can also squirt out poison clouds.

"But if we have a lot of bluffers, we have also some really dangerous characters in insect land, which attack even four-footed animals and kill them single-handed. There is a huge African locust which catches and kills mice and small birds for food.



This little creature known as "Gray's Spiny Stick-Insect," looks so much like the thorny bushes on which it feeds that its enemies have trouble in finding it. It's nearly a foot long.



On the left is a species of Weevil whose "thorns" make him an unpleasant mouthful. On the right is the Ruby Wasp, which is protected by an extremely hard shell.

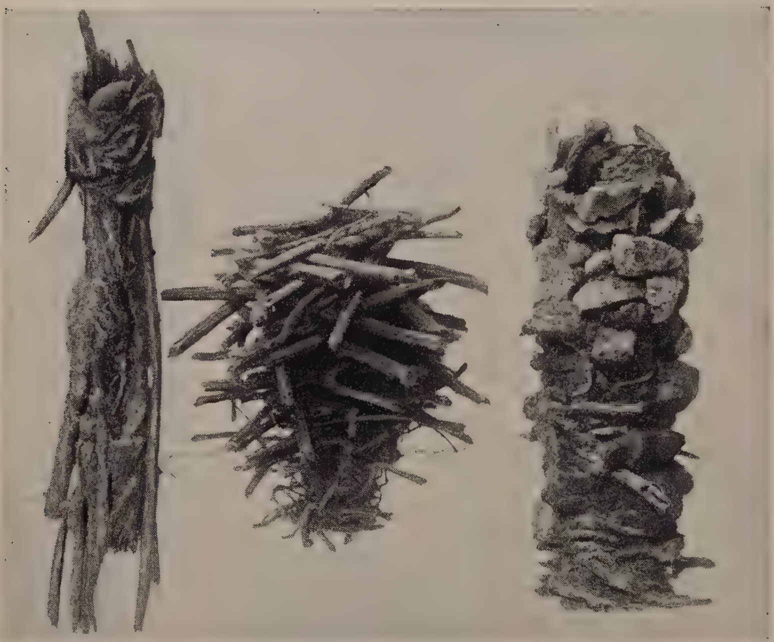
And if I had time, I'd show you in the lake over there how the giant water-bug can kill small frogs and fish, seizing them in his powerful front legs and plunging in his deadly beak. But I must get back to my work." And with these words the old ant hurries away.

In the Fairyland of Change

If the ant had had time he might have explained that wonderful feature of insect life we call *metamorphosis*. With very few exceptions, insects grow from eggs. Most species after hatching from the egg do not resemble their parents at all. They may be smooth wormlike creatures, such as the maggot of the bee or the fly, or they may be hairy like some caterpillars, or big fierce-looking grubs like the young of the tiger-beetle. At this period of its life, the insect is called a *larva*, and its only duty is to eat and grow. The period may last only a few days, as is the case with bees and flies, or it may extend over years, as in the case of the cicada or "17-year locust." This period may be spent burrowing in the ground, hiding in holes in the trunks of trees, swimming in the water, or crawling about in the open air—each according to its kind.

In due time, however, the insect enters the *pupa* stage or *chrysalis* stage (as it is called in the case of butterflies and moths), which is a period of sleep. For this purpose many larvae, such as caterpillars, form a sort of silken cradle called a *cocoon*. During this sleep, the whole shape and structure of the pupa changes, and when it awakes and bursts out of its old skin, it has become for the first time a fully-developed insect (*imago*) like its parents. The ugly caterpillar, for instance, has turned into a handsome butterfly or a moth.

FORTIFIED CASTLES OF THE CADDIS FLIES



In their larval stage, the Caddis Flies live under water and cover their soft white bodies with silken tubes, to the outside of which they attach various materials—sand, twigs, bits of stone, and so on—as a means of protection. Different species have different protective materials, as shown in the illustration.

But there are many strange variations and exceptions to this law of metamorphosis. Some insects, like the oil beetles, pass through two or more larval forms before they become pupae, and the mayflies undergo an additional change after they leave the pupa stage. There are, on the other hand, many groups of insects, such as the grasshoppers, locusts, crickets, and all true bugs, in which the young resemble the parents just as soon as they hatch from the eggs, needing only to grow larger, and to develop wings, if they are of the winged kind. Such young insects are called *nymphs* and not larvae. During the growing period, nymphs shed their skins several times. This is necessary because the chitin covering of an insect cannot stretch.

There are exceptions also to the egg stage, for the young of some insects are born alive. Such insects are called *viviparous* (Latin *vivus*, "alive," and *pario*, "bring forth"), to distinguish them from egg-laying insects, which are called *oviparous* (Latin *ovum*, "egg"). Plant lice or aphids have the curious habit of sometimes laying eggs and sometimes producing living young. These tiny green creatures also illustrate the practice, not uncommon among insects, in which the females bear young for many generations without the males. This is called *parthenogenesis* (from the Greek words meaning "virgin birth"). Furthermore, there are insects which produce young while still in the larval stage, and others while still in the chrysalis or pupa stage.

The social groups of insects—ants, wasps, and bees—rank highest in intelligence. These have learned the lesson of coöperation, which reduces the struggle for existence to its easiest terms. With them, the spirit of the hive or nest rules supreme over the willing workers. From the earliest times, men have found inspiration to devotion and self-sacrifice in the lives of these ingenious insects. (*See* Ant; Bee.)

In general, it is in the nest-building habits of insects that their highest skill is shown, rivaling many of man's cleverest accomplishments. The carpenter bee, for instance, bores into the solid wood and builds cells for its eggs. The mason wasp constructs a beautiful home of mud. There are spinners of silk and makers of wax, upholsterers, workers in wood pulp and tree gums, and hundreds of other special trades and professions represented in the insect world.

Most of these nest builders store up food for their young. It may be honey, or pollen, or the bodies of other insects killed for this purpose. Some wasps even store up living insects, after paralyzing them with their stings, so that their young may have fresh food when they hatch from the egg.

THE SHARP "SWORD" OF THE BEE

A Bee's sting feels fully as big as this when you get it into your bare foot, but here it is much magnified of course. Those little barbs are what make it stick. Connected with this weapon is the poison gland which makes the sting hurt so.

What happens to insects in the winter time? Most of them die, leaving eggs or half-developed young to await the warmth of spring under ground or in some other protected place. In certain species, like the social wasps, the female sleeps through the cold weather and lays the eggs for the new generation as soon as warm weather comes. The colony life of ants and bees, however, continues all the year around.

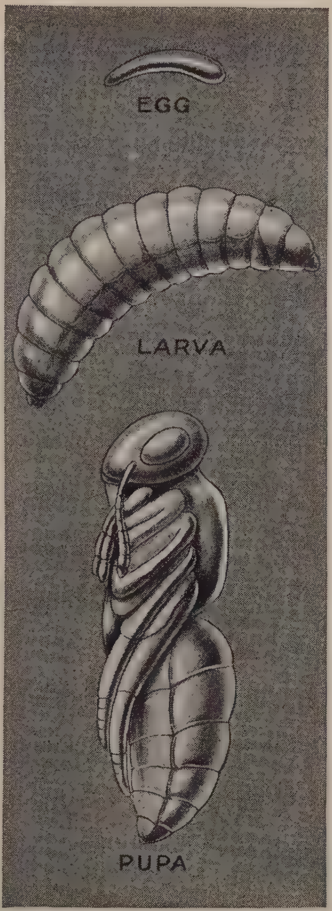
How Insects are Made

The chief distinguishing feature of insects is that all of them have six legs, which gives them the scientific name *Hexapoda* (from the Greek *hex*, "six," and *podes*, "feet"). Their bodies are always divided up into segments or rings. There are a great many creatures which closely resemble insects and are often mistaken for them—for instance, spiders and scorpions, which have eight legs; centipedes, with dozens of legs; mites and ticks, which have sacklike bodies unbroken by segments.

Insects, however, belong to the larger group of creatures with jointed legs called *Arthropoda*. This includes not only centipedes, spiders and scorpions, but shrimps, crabs, and lobsters, as well.

The name "bug," which is often applied to insects in general, really belongs to certain special kinds of insects only. Among other peculiarities which distinguish the true bugs from other insects is the beak with which the members of this order suck the juices of plants as well as the blood of animals.

METAMORPHOSIS



Here are the egg, larva, and pupa of the Honey Bee, illustrating the three stages through which most insects pass before they become real "grown-ups."

The body of an insect is divided into three parts—head, fore-body or thorax, and hind-body or abdomen. The head bears the delicate feelers or antennae, the mouth parts, and the eyes. The sense of smell is situated in the antennae. There are two sorts of insect eyes, the large compound kind, made up of a great number of separate facets or lenses, and the simple eyes or *ocelli*. Many insects have both kinds, the ocelli being situated between the two prominent compound eyes. In certain mosquitoes and gnats the ears are found in the antennae, but in most insects they are not on the head at all, but between skin-layers on the body. Crickets and grasshoppers have ears on the shins of their fore legs.

The mouths of insects are supplied usually with *mandibles*, or pinching jaws, and *maxillae*, or biting and chewing jaws. The size, shape, and arrangement of these mouth parts vary greatly in different species. In the true bugs, it is the mandibles which are modified into sucking beaks.

The thorax bears the three pairs of legs and the wings, when these are present. The typical insect has four wings, but in many species, such as the housefly, they are reduced to two, and in many others they have disappeared altogether. In some insect groups, the males only have wings, in others only the females. Certain species, like the plant lice, develop wings only under special conditions of diet or weather. Often, as in the beetle tribe, the front wings of insects have become armored wing-covers, which protect the delicate rear wings when the latter are not being used in flight.

The abdomen, consisting of several segments and joints, contains the digestive tract and in females the egg-laying apparatus or *ovipositor*. This is often very delicate and complicated, enabling the insect to bore into the ground, or into trees, or through the skins of other insects to lay its eggs. The poison sting, when present, is situated conveniently at the tip of the abdomen.

Insects have well-developed brains and nervous systems. A simple contracting heart-sack provides for the circulation of blood. They have no lungs and do not breathe through their mouths. Air is drawn in through tiny holes or *spiracles* in the body-segments, and passes through an intricate system of branching tubes or *tracheae*, carrying oxygen direct to all parts of the body.

The muscle system in insects is perhaps as delicate and complicated as in any higher animal. Scientists with microscopes have counted as many as 4,000 muscles in the body of one small caterpillar.

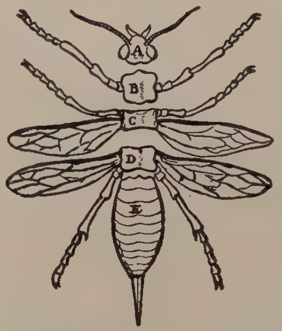
The collection and study of insects is fascinating and profitable work for old and young. Insects are best captured by using a butterfly-net. They may be killed

BUILT FOR BATTLE

The Red-banded Sand Wasp with its long slender waist and its poison dart is one of the most skilful fighters of the Insect World.

without injury by dropping them in a glass jar filled with the fumes of benzine, alcohol, ether, chloroform, carbon disulphide, or potassium cyanide. Once they are dead, the insects should be spread out in their natural attitude on a soft board, and held in place with fine pins until they dry. They may then be mounted on long pins thrust through the thorax and into the bottom of a shallow box. When mounted, labels bearing the name of the specimen should be neatly pasted underneath. A small magnifying glass is a great aid to insect study.

PARTS OF AN INSECT



The typical parts of an insect are shown: the head (A); the first joint of the thorax (B), bearing the front legs; the second joint (C), bearing middle legs and front wings; the third joint (D), bearing hind legs and second pair of wings; the abdomen (E), bearing the egg-laying apparatus and the sting when present.

About 300,000 species of insects have been collected, named and described by scientists. But by far the greater part of the insects which inhabit the world are still unknown to science. Hundreds of new species are discovered every year. Estimates of the probable number of species run from one to several million.

As a class, insects are found in virtually all parts of the earth, many species existing inside the Arctic circle. But insects flourish best in warm countries. In the tropical forests of Africa insects of every kind swarm in such numbers that, as the explorer Henry M. Stanley said: "There must be no sitting or lying down on this seething earth. Venom, fury, voracity, and activity breathes around you."

From man's point of view, insects may be divided into the harmful and useful classes. Many kinds, like grasshoppers and locusts, plant lice, scale insects, cotton weevils, and the caterpillars of nearly all moths and butterflies do an immense amount of damage to trees, crops, domestic animals, and food stores, estimated for the United States at two billions of dollars annually. Others, such as cockroaches, flies, fleas, mosquitoes, and gnats, annoy men and animals and even spread some of the most dreaded diseases of mankind, such as malaria, yellow fever, and that frightful scourge, bubonic plague.

But there is another side to the story which is too often overlooked. If it were not for bees and other honey-seeking insects, which carry the fertilizing pollen from flower to flower, it would be almost impossible to raise many kinds of fruit and other crops. If it were not for the beetles and wasps and others, which destroy every year vast numbers of the harmful insects, our fields and gardens would be overrun with pests of all kinds. Many of the insects which burrow in the ground do a great work as cultivators, turning over and airing the soil. Countless scavenger insects help the bacteria in getting rid of refuse for us. On the whole, these friends of man go a long way toward paying off the debt of his insect enemies. Besides, certain insects manufacture substances of great value, such as silk, honey, wax, dyes, and shellac. Among all the insects, however, men have found only two kinds that could be domesticated with profit—the silk-worm and the honey bee.

Insects appeared on earth long before mammals, some scientists claiming to have found insect remains in Silurian rocks (*see* Geology). It is certain that the forests of the Coal Age contained many insects, some measuring two feet across the wings. From that time on, thanks to their rapid propagation and powers of concealment and defense, they have held their own against later forms, and today they are man's most formidable rival for mastery of the earth and its riches.

How Science Classifies the Insects

The classification of insects for scientific purposes varies as new species are discovered. The following list of orders is one recently approved by American entomologists, as the students of insect life are called; it is based largely upon the structure of the wings and mouth parts. For each order one or two type examples are given.

Order
I. *Thysanura*, no wings (examples are bristletails, spring-tails, fish moths).
II. *Ephemerida*, delicate wings, two adult stages (mayflies).
III. *Odonata*, four wings, aquatic larvae (dragon flies).
IV. *Plecoptera*, folding wings, breathing gills in the larvae (stoneflies).
V. *Isoptera*, four wings alike (termites or white ants).
VI. *Corrodentia* (book-lice, tiny insects living in books).
VII. *Mallophaga* (bird-lice, parasites often found on poultry).
VIII. *Euplexoptera*, rear wings delicate and folding up in complex manner beneath small wing-covers, some wingless (earwigs).
IX. *Orthoptera*, straight wings (grasshoppers, roaches, crickets).

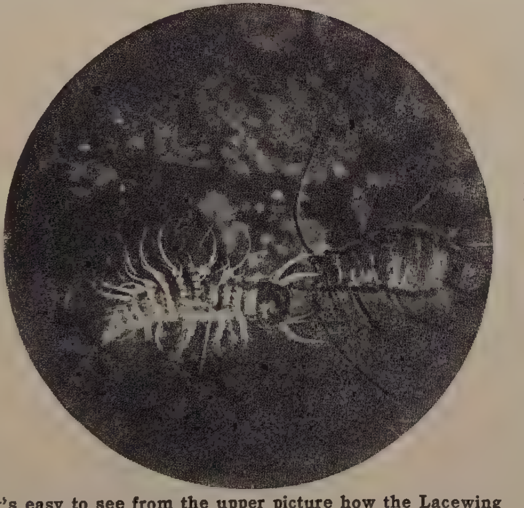
Order
X. *Physopoda* (thrips, tiny creatures usually inhabiting flowers).
XI. *Hemiptera*, piercing beaks (ordinary lice, water boatmen, cicadas, and all other true bugs).
XII. *Neuroptera* net-veined transparent wings, pupae free (ant lions, dobsons).
XIII. *Mecoptera*, (scorpion-flies, body shaped like scorpion).
XIV. *Trichoptera*, aquatic larvae, build movable houses of sticks or stones (caddis flies).
XV. *Lepidoptera*, scaly wings (butterflies and moths).
XVI. *Diptera*, two wings (common flies, gnats, mosquitoes).
XVII. *Siphonaptera*, piercing jaws, no wings (fleas).
XVIII. *Coleoptera*, sheath wings (all beetles).
XIX. *Hymenoptera*, four membranous wings (bees, wasps, ants).

Some Mysteries of Insect Life

HAVE you ever thought, when you have watched an insect creep along a flower or leap into the air or disappear into the earth, that you are watching a mystery which no man who ever lived has yet been able to understand? This little insect, which you can crush out of existence with your finger, is as wonderful as the stars.

Sit in the twilight of some summer evening, and watch the winged procession of the lacewing flies that have been called the loveliest insects in the animal kingdom. The body of this fly is a pale emerald green; its lacelike, silvery wings are iridescent with lovely hues; its eyes are veritable living jewels, sparkling one moment like burnished gold, the next moment like rubies of deepest crimson.

We look up at it for a moment; we say to ourselves, "What a beautiful thing!" and it is gone. But there has flown past us in that moment a wonder that no man knows. That little lacewing fly will presently settle on a leaf, will press against it, and eject from its body a drop of sticky fluid. The drop of fluid rests upon the leaf, and out of it this little mother draws a thread almost too fine for us to see. The thread hardens in the air, and at the end of it, hanging in space, this little mother lays an egg. We go about our business, and the earth spins around seven times and then out of the egg at the end of the thread creeps a living thing. It creeps along the thread towards the leaf, and on the leaf is a giant—a creature twice as big as itself, an evil thing that eats up the life of roses and destroys our gardens. But the little stranger is not afraid. It has just come into the world and has never met a living thing before, but it grips this destroyer of roses, wrestles with it, crushes it, and in less than half an hour throws on one side the empty shrunken skin of its first victim.



It's easy to see from the upper picture how the Lacewing Flies get their name and why they have been called the loveliest of all insects. The center picture gives a magnified view of a Lacewing egg hanging from its tiny cable. The third picture is a magnified photograph of a Lacewing larva (on the left) attacking a Green Fly.

We need not claim this larva as a conqueror, nor attribute to it any virtue; it is enough to see what happens. Its first aphid gives it an appetite for more, and it creeps about destroying them until, by the time it is ten days old, it gobbles up 30 in an hour, and by the time it is 12 days old it will eat an aphid every minute. It is a cannibal, for it will suck the eggs of other lacewing flies—a fact which may explain why the mother lays her eggs at the end of a thread. Perhaps the little mother knows that her children will eat the eggs upon the leaf, but will not climb the thread. That is a difficult journey, the first journey of a lacewing larva in the world, and it goes that way only once.

At 12 days old the larva draws itself up like a ball on the edge of a leaf, spins something very much like a piece of delicate silk, and wraps itself up from the cold. In an hour or two it has changed into a round cocoon, like a pea, and on the edge of the leaf it lies still for 16 days. Then, from within, the little ball is opened, a round lid lifting, and out comes a lacewing fly.

"It is surprising," one naturalist tells us, "how so large an insect can develop in so small a cocoon, but immediately it appears upon the surface of the leaf its wings begin to shake out their folds, and a few minutes later we see the insect developing in all its charming hues. Its bright green body, its gauzy and iridescent wings, and its sparkling eyes — together with its abominable characteristic of producing a vile odor—have all been acquired in some mysterious way during the 16 days while it was crushed within its cocoon upon the leaf. How the magic was performed is a secret hidden deep within the pages of Nature's book."

It has taken five weeks to make this tiny creature: 7 days in the egg, 12 days—12 creeping, killing days—

as larva, and 16 days in the cocoon, where something happened which all the wisdom of the world has not been able to explain.

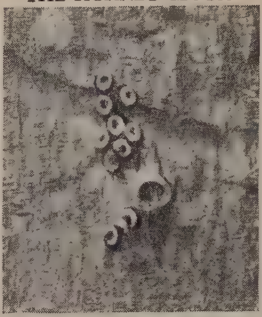
That is the tale of the lacewing fly. How many hours of summer days we have sat watching that other little fly, which fixes itself in a point in space and beats its wings so fast that it seems to be perfectly still, until suddenly it darts to another point not far away and rests there, seemingly still again, except that we know it has nothing to rest on, and is holding itself up by the marvelous beating of its wings! It is the hover-fly, one of the wonderful little beauties that make a garden in summer a marvelous place to be in. Out of the egg of the hover-fly creeps a tiny grub, as long as the 16th part of an inch, and with neither eyes to see nor legs to walk. Yet this blind and creeping thing has a strength that we can hardly believe. It travels down a stem, and by chance an aphid touches it. It cannot see, it has had no experience of the world, it has hardly begun to feel what it is to be alive; yet this tiny grub pounces on its prey, racing after it by means of the rough edges of its skin. This is what one observer writes of it as he has seen it happen:

"Instantly the grub thrust its head forward, and a moment later it was standing upright on the tail-end of its body with the aphid elevated in the air. In this attitude the little grub held the aphid for over an hour while it sucked its juices, and this in spite of the fact that its victim was much larger than itself, and continually struggling to escape. It then cast away the empty skin of the aphid, and rested for a while. During the first day of its existence it captured and ate two half-grown aphids and two smaller ones, and day by day, for ten days, its appetite increased in an astonishing manner."

Ten days pass away, ten days of hard feeding, and then this grub hangs to a leaf and stays there another ten days. Its skin is hardening as it hangs, and at last breaks, and out of it, shining in black and yellow bands, comes a little hover-fly.

One more peep at the wonder of insect life. We will take the hornet-moth, laying her little brown eggs on the bark of a tree. One day the caterpillar creeps out of the egg, and, instead of setting out in search of aphids, this little creature begins to burrow into the trunk of the tree, boring its way until it reaches the center where it eats a tunnel along the trunk several inches long, and widening as it lengthens. It has found its home. Here it grows and lives perhaps two years, never leaving its dark and narrow house, but taking care to guard itself against invaders by blocking the end of the tunnel with wood scrapings held together by silklike threads, spun by the caterpillar and woven with the wood to make a barrier. Thus guarded, the larva lives until it is full grown, and then, as if it were making up its mind, it turns around and faces its front door! It is as if this strange thing knew what was about to happen; and perhaps it does, for now that it has turned around it molts its skin and becomes a chrysalis. *Had it not turned before, it could not do so now,* for in its new coat, hard and brown, it could not possibly turn around in such a narrow space.

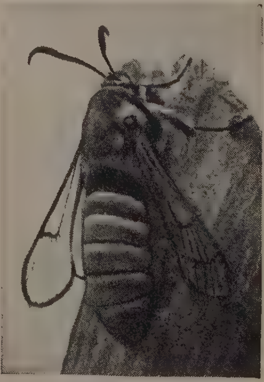
THE HORNET-MOTH



Eggs of the Hornet-Moth

Larva eating into a branch

Looking out into the world



Now it has its wings

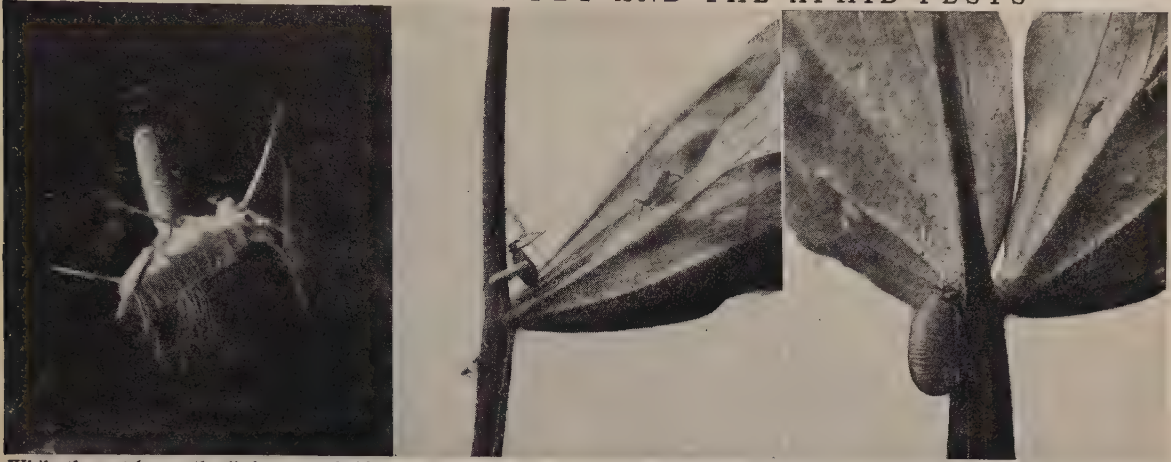
With its head toward the entrance of its tunnel, the chrysalis lies for perhaps four weeks. And what happens then we may let a well-known naturalist tell us. He is looking at the little hole in the bark of the tree, a neatly drilled hole just big enough to take an ordinary lead pencil!

"The sun's rays are falling directly into the hole, partly illuminating its interior, and while we are wondering what function the hole could serve we suddenly become aware of the fact that there is something moving inside it. What can it be? Some inquisitive insect, maybe, that has entered and is now returning.

"Presently the forepart of a shiny brown body appears, gradually advancing by little bunts as if pushed from behind, until at last it is distinctly protruding from the hole. Still it continues to advance, and just when we expect to see the curious object fall on the ground an extraordinary transformation scene takes place.

"The brown skin suddenly breaks open, and from it a wasplike insect with a black-and-yellow banded body crawls onto the bark. Its wings at first look soiled and crumpled, but in a few minutes they unfold from their creases, and the insect at once begins to travel up the branch, continuing

THE HUNGRY HOVER-FLY AND THE APHID PESTS



While the ant keeps the little green Aphids for dairy cows, the grub of the Hover-Fly prefers them in the form of beefsteak, as you can see from the picture on the left. The grub, only two days old, is killing a victim much larger than itself. The middle picture shows it dining on one Aphid, while another seems to be waiting its turn to be eaten. In the third picture, the Hover-Fly grub, after growing big and fat, has turned into a pupa.

until it reaches the cut end left by the woodman. There the hornet-like creature suns itself for an hour or more, looking decidedly dangerous even as it rests. When the sun is at its brightest the insect's feelers quiver excitedly, and then, with a beelike buzz, it takes to its wings."

This is not half the wonder of the hornet-moth, but then not half the wonder of anything in Nature has yet been told. There is no sign of intelligence, it may be said, in these strange things; but intelligence is in the order of the world, and the purpose of hover-flies and lacewing flies, we may guess, and a host of insects such as these, is to keep the balance of life so that we may live.

Here the Hover-Fly has just emerged from its pupa case and will now spend its time hovering in the sun, so justifying its name.

Hidden away in our gardens every winter, lying still and knowing nothing, is a vast army of creatures that no man can number. Through all these wonderful months they have lain there, in silence and darkness, while the great world has gone by and men and women and nations have lived their lives. And every year, in the dawning summer, this army bursts out into the sun. It is made up of the countless myriads of hover-flies from last year's cocoons, the last brood of larvae last year, too late to come to their full life then before the winter came, and kept in suspense until now.

This great army of little soldiers is one of the beneficent forces of the world. It finds, already waiting for it, a host of aphids which, if there were no conquering host to pounce upon it, would in a short time make life impossible for you and me and all other living things. In its few short weeks of life one single aphid may bring 6,000 million other aphids into life; and it was Professor Huxley, who did not exaggerate these things, who calculated that the descendants of one aphid if unchecked for only ten generations—that is to say, throughout one summer—would produce a bulk of matter equal in weight to all the living people on the earth!

Well, the lacewing flies and the hover-flies will be waking soon, and the aphids may look out. We shall go on our way, and most of us will think nothing about it; but, whether we know it or not, we may rest and be thankful, and sleep comfortably in our beds, knowing that Life will not fail us, but that her myriad hosts will maintain the balance upon which all our lives depend.

INSURANCE. In our daily lives we are surrounded by dangers and risks. The father of a family may die suddenly and leave his widow and children penniless. He may be struck by an automobile and lie for weeks in a hospital. His home or his store may burn down. No one knows but that he may be the next victim of misfortune, so he is willing to pay a certain yearly sum of money in return for assurance that he or his family will receive a much larger sum in case of misfortune. He does this by joining a company of men who also want the same protection. Each member pays a certain amount into the treasury. When one of the members dies or his house burns down or he has an accident, the insurance company pays him or his family a certain agreed sum.

That, in a nutshell, is the fundamental principle of insurance. It rests upon the obvious fact that a burden which would crush one man can easily be carried if distributed among many men.

Insurance companies are of many kinds. Life insurance companies pay the survivors in case of death. Fire insurance companies pay for loss through fires. Others insure against accidents, ill health, the loss of ships at sea, against burglary and theft, against damages to automobiles or other property, against almost everything that can happen to cause a man physical or financial suffering.

The amount paid for protection is called the "premium." This is figured out according to what is called the "law of averages." This law is well illustrated in the case of fire insurance. For a great many years insurance experts have kept track of the numbers and kinds of houses that have burned down in the United States. From year to year the percentage of fires is about the same for each kind of building. Suppose it has been found that, out of every thousand grocery stores, one burns down every year, on the average. The chance, therefore, that any particular store will burn down is one in a thousand. The premium is fixed on this basis. If the figures showed that two out of every thousand had burned down, the premium would be twice as high.

Premiums vary also according to the amount to be paid in case of loss. If the grocer wishes to insure his store and goods for $2,000, he pays twice as much as he would if he only wanted to insure them for $1,000. Precautions are taken to prevent a man from insuring his property for more than it is worth, for that would encourage dishonest persons to start fires in order to obtain the insurance money.

Life insurance is figured on the basis of what is called the "law of mortality." Records for long periods show that out of every thousand persons so many on the average will die at the age of 30 years, so many at 40, so many at 50, and so on. From these mortality tables insurance companies are able to determine with reasonable accuracy how long a healthy person of any given age may expect to live. This enables them to fix their premiums at a scale which will give them a profit after paying all losses and expenses.

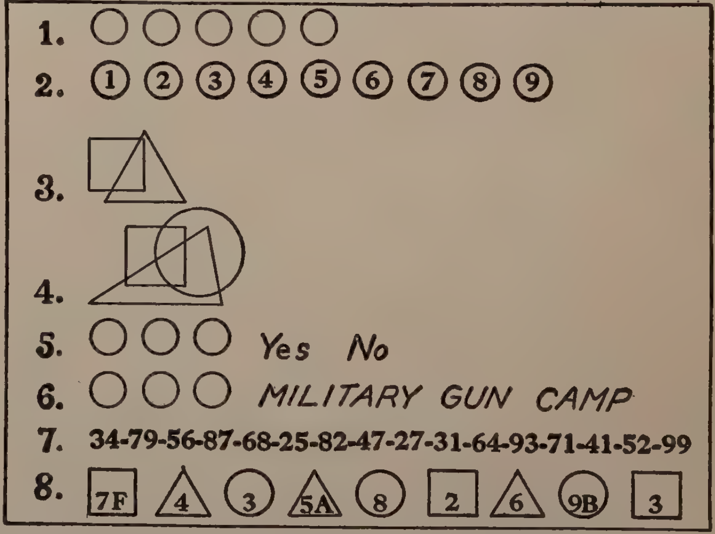
Employers in many states are obliged to carry "workmen's compensation" insurance to safeguard workmen and their families in case of death or injuries due to their employment. Many fraternal societies issue life, accident, and sickness insurance for the benefit of their members, and many big industrial plants do the same thing for their employees.

During the World War, the United States established a system of insurance for men and women in military or naval service. The government itself bore all the expenses of managing this war risk insurance and issued policies based on the death rate in time of peace, thus assuming all the hazard created by battle. The annual premium was approximately eight dollars per thousand dollars, a very much lower rate than that charged by insurance companies. Ninety per cent of the troops sent overseas were insured in this way.

The largest organization in the world for the writing of insurance is Lloyd's of London. This is an association of insurance companies which will accept almost any risk on payment of a premium which varies with the risk. The chief purpose of the association, however, is insurance of ships and cargoes, and for this purpose it maintains an enormous organization, which reaches to every corner of the globe, to collect shipping news. Lloyd's had its origin in the 17th century in a coffee house kept by a retired seaman, Edward Lloyd, in London.

INTELLIGENCE TESTS. The modern soldier must have intelligence, and, particularly for certain kinds of duty, a high grade of intelligence. Since it cost $2,500 to train, equip, and transport a soldier over seas during the World War, Uncle Sam was naturally interested in finding out, before he made this investment in a soldier, whether he had the mental ability for making a good one. So the intelligence of about 1,727,000 men was examined, and out of this number

HERE'S A TEST FOR QUICKNESS AND ACCURACY



The instructions for each part of the test and time in which they must be carried out are as follows: 1. Make a cross in the first circle and a figure 1 in the last circle—five seconds. 2. Draw a line from circle 2 to circle 5 that will pass *below* circle 3 and *above* circle 4—five seconds. 3. Make a figure 2 in the space which is in the triangle but not in the square, and make a figure 3 in the space which is in the square and in the triangle—ten seconds. 4. Make a figure 2 in the space which is in the triangle but not in the circle or square, and make a figure 3 in the space which is in the square and circle but not in the triangle—ten seconds. 5. If a captain is superior to a corporal, put a cross in the second circle; if not draw a line under the word "No"—ten seconds. 6. Make in the first circle the third letter of the first word, in the second circle the first letter of the second word, and in the third circle the first letter of the third word—ten seconds. 7. Cross out each number that is more than 60 but less than 70—15 seconds. 8. Draw a line through every *even* number that is not in a square, and also through every *odd* number that is in a square with a letter—25 seconds.

about 10,000 were rejected as mentally unfit—a clear saving of at least $25,000,000. More important, it was possible to pick the men best qualified to make officers, aviators, gunners, scouts, etc., and thus to select the best material for winning the war.

How was this done? By the use of charts similar to the one reproduced on the opposite page containing tests of quickness and *intelligence* and in the ability to follow directions exactly. Other tests called for the use of common sense, ability to discriminate between synonyms and antonyms, understanding of related words, and general information. Very specialized tests were used to determine the particular abilities required in such branches of the service as aviation. These army tests revealed that more than 45,000 of the men had mental intelligences no greater than those of ten-year-old boys.

TESTING THE SPEED OF EYE AND BRAIN

A big electric company in Germany tests apprentices by showing printed words for an instant like this, and then asking the boys to tell what they saw.

These tests are to a large extent based on what are called the Binet-Simon tests, which were devised by the French psychologists Alfred Binet and T. Simon to determine the intelligence of school children.

Certain tests were selected which seemed characteristic of the ability of average or normal children at various ages from three to twelve. There was also a set for the age fifteen and another set for the normal adult. Such tasks as showing the nose, eyes, and mouth; repeating two digits (as four and seven) after they have been pronounced by the examiner; telling what objects are seen in certain pictures; giving the family name; and repeating a sentence of six syllables, were found to lie within the ability of normal three-year-old children. Similar but, of course, more difficult tasks were used for the different ages above three years. These tests were selected to test natural intelligence, rather than school or home training, and hence cover a wide range.

While it has been found by investigators that the normal child can do most of the tasks characteristic of mental ability at his age, the backward child is able to do only such tasks as can be done by normal children one to three years younger. It has likewise been found that the child who is able to do the tasks that can be done only by normal children two or three years older, also makes better school marks, and can do as much and as difficult school work as the normal children born two or three years earlier. Furthermore, he is not only able to keep up with his class, when promoted beyond the level of his chronological age, but he is usually found doing superior work and in some cases may be further advanced even more rapidly than the normal children without risk of overwork or failure. On the other hand, it has been found that those children who are two or three years *below* normal children in mental age tend to fall still further back in their work in school with advancing years. Thus these tests are of very great value to educators in the administration of school affairs, and use is also made of them by the courts in dealing with juvenile offenders.

The Binet-Simon tests have been translated into English and adapted to American conditions by Dr. Lewis M. Terman of Leland Stanford University of California. Similarly, the army intelligence tests have been adapted for public school use, especially by a committee appointed by the National Research Council. Their tests for grades three to nine inclusive have become the standard for these grades. Similar though less satisfactory tests have been prepared for primary grades, and group intelligence tests are available for high schools. Millions of public school pupils have been tested, and the practice of giving such tests to all school children is becoming a settled one. There is also a growing practice of segregating pupils in the public schools on the basis of such tests for the purposes of instruction. Classes for backward and subnormal children have long been provided in good public schools and classes now are being organized also for gifted children.

Similar tests, with broader scope to include the powers of more mature minds, have been used with varying success in some American universities in place of the ordinary entrance examinations. Business concerns have tried similar tests in hiring employees.

INTERNATIONAL LAW. "The law of nations," or international law, is the group of rules and principles which by general agreement the states of the civilized world observe in their relations with one another. Rome had a code of laws (called the *jus gentium*) governing its relations with foreigners in which we find some of the early beginnings of this modern international law. As the strangers who went to Rome were not citizens, they did not come under the jurisdiction of the Roman law and had to be governed by this separate code. With the growth and intercourse of the modern states at the close of the Middle Ages, the need of an accepted body of principles governing their relations began to be felt; and a number of writers, foremost of whom was Hugo Grotius, a Dutch scholar, published treatises on the subject. In Grotius' book, 'De jure belli ac pacis' (published in 1625), we have the basis of much of the subsequent work on the subject, including the following principles: (1) War should be carried on only for a just cause, and for the purpose of defense. (2) Do no more injury to the vanquished than is strictly necessary. (3) Force alone ought not to regulate the relations of peoples, for there is justice between states as well as between individuals. (4) To observe treaties is the wisest practice and the greatest strength of sovereigns.

In a strict sense international law is not *law*. It is only a body of customs and conventions which the nations have agreed to accept, and its force depends on the good faith of the states that accept it. Treaties, ordinances of states, decisions of international tribunals, and the opinions of prominent jurists are studied to determine what rules have been most generally accepted. In recent years international congresses have been held to determine and interpret various phases of international law, the most important of these being the Hague Peace Conferences held in 1899 and 1907 (*see* Hague Peace Conferences).

International law recognizes that a sovereign state has complete authority within its own borders, and in the case of maritime states a jurisdiction over the sea for a distance of about three miles from its coast. The freedom of the high seas, or that part of the ocean which lies beyond the three-mile limit of maritime states, is possessed by all.

In reducing the sufferings of war, international law made considerable progress, but the practices of the World War violated many cherished principles of this subject. In general the use of instruments of warfare which inflict undue suffering—such as poisoned weapons and expansive or "dumdum" bullets—is forbidden. Similarly the rules governing naval operations were largely modified in practice in the World War, owing to the new conditions under which the war was carried on. Formerly a neutral vessel could be seized only if it was carrying "contraband"—that is, goods of predominantly warlike use (such as munitions) or other articles (such as foodstuffs) destined for the enemy forces or government, or if it were seeking to break a blockade formally declared, or the like. But the new conditions of submarine warfare made such rules obsolete. A century ago private shipowners often received from a belligerent government commissions called letters of marque and reprisal authorizing them to make captures on the high seas, but these are no longer granted, and "privateering" is a thing of the past.

The question of neutrality is particularly important in connection with naval operations. Theoretically every state has the right to remain neutral during a war, and it is the office of the executive in such case to issue a proclamation stating that the country wishes to remain neutral. This means that the country will take no part in the war and will treat the belligerents impartially. Neutrals are forbidden to allow the use of their territory for military operations, to aid the belligerents in their actions, to trade in contraband, or to violate a blockade.

INTERSTATE COMMERCE COMMISSION. Suppose railroads could charge whatever they chose for carrying passengers and freight. In that case they might give certain individuals or companies lower rates than others for the same service. This discrimination would cause the favored persons or companies to succeed, while their competitors would fail or work at a disadvantage. In a similar manner the railroads might favor one section of the country more than another, by differences in rates and quality of service. When fruit and vegetable crops were ready to be shipped, if the railroads failed to furnish cars sufficient to get these perishable crops to market quickly, growers and shippers would suffer great losses.

In the early days of railroad development in the United States, such discriminations were common. To correct these practices the Interstate Commerce Commission was provided for by act of Congress in 1887. The Commission as now constituted is an administrative body of seven men whose duty is to see that railroad rates are fair and reasonable, that trains are run on a fair schedule, and that cars are distributed between shippers without favoritism. The railroads are required to publish their rates so that anyone may see just what he ought to be charged. The Commission hears complaints from passengers and shippers regarding both rates and service and the carriers must make the changes and corrections which the Commission orders.

The Commission also regulates all interstate "common carriers," such as sleeping-car companies, express companies, telegraph, cable, and telephone companies, and oil pipe-lines. All such companies are required to make annual reports to the Commission, and it has general supervision over the financial and business transactions of the companies.

Such regulation is based on the clause in the United States Constitution which gives Congress power to "regulate commerce among the several states." Hence the Interstate Commerce Commission deals in the main only with service and rates between points in two or more different states.

INVENTIONS *that have* CHANGED *the* WORLD

WHAT would the great Archimedes, or Shakespeare, or George Washington have said of the marvelous inventions of our day? From chaos to civilization, and on to the wonders of the 20th century, we trace the history of Man's inventive genius—which too often, alas! has brought only persecution from his contemporaries.

INVENTIONS. What is it that has made the barren earth a garden, that has changed the scene of man's life from a wild battlefield with the beasts to a workshop in which he can build up a new world? Professor Huxley and Herbert Spencer sat one day by the sea, watching a man bathe, and they laughed, as they gazed upon a naked man, to think that he should have overpowered all other creatures. What is that something—intangible, invisible—which impels man on in the universe, which has raised him to the very heights of power, and enabled him to fashion Nature itself to his will? It is the power of invention.

How man rose out of the mists of Time, how he made a fire, how he tilled the earth, how he sailed the seas, how he made machines; how he invented speech and writing and society; how he grew differently into races and nations; how he wrote books, painted pictures, and carved marbles; how hordes of savages ceased destroying one another and built up great empires; how their empires rose and swayed the world and fell; how Babylon became a heap of stones; how men tunneled the Alps and spoke across the seas; how they built cities, made laws, and set up schools; how civilization came out of chaos—there is no story in the world so wonderful as this, the story of the triumph of inventive man.

That is the dominant fact of the physical universe. There are those who tell us that man could never have obtained the mastery of the earth without his thumb, and it is perfectly true that if human beings had had four fingers and no thumb set over against them, the history of the human race could not have been. But amazing as is the human body—the most perfectly constructed machine upon the earth—men might still have been living in caves and battling with beasts if their bodies had been their chief possession. Man is a creature, says Shakespeare, looking before and after, and man's power of looking before and after has made him lord of Life.

The creative mind of man—this mind that cannot understand itself—has built up the whole structure of human knowledge, and on this foundation of knowledge has invented a thousand things that have made the world what it is.

If we could imagine a man born in the world tomorrow finding the world a blank, with not a human being or a book to tell him yea or nay; and if we could imagine this man peering into the skies, digging into the earth, descending into the seas, flying into the air, measuring the stars and photographing the moon, bending intently over the earth, touching a field as with a magic wand and raising up flowers and fruit, snatching power from space and water to do the work his own hand could not do, taming animals to bear his burdens, making machines to increase a millionfold his powers of speech and sight and hearing, filling the air with music and the earth with color, talking to a piece of wax and teaching it to talk back to him, reproducing any scene his eyes could look upon for his pleasure after it had passed, speaking a word in America to be heard in Europe, making light to shine through stone and inventing eyes to see his own heart beating—if we could imagine such a man, doing this and a million times more than this, with no other instrument to help him than his own mind, grown from a tiny speck that no eye could see, should we not think of him with fear? Should we not think him almighty? Yet man has done that, and more than that. All that and more he has to his credit in his long journey through the centuries.

A GREAT INVENTOR OF ANCIENT TIMES

When the Romans besieged Syracuse, the mathematician Archimedes, who was a native of the city, lent his genius to its defense. He devised engines like this one for hurling rocks upon the Roman ships. The long and powerful spring lever was drawn back, a stone was placed on its spoon tip, the trigger was released, and the missile hurled out like a pebble from a sling.

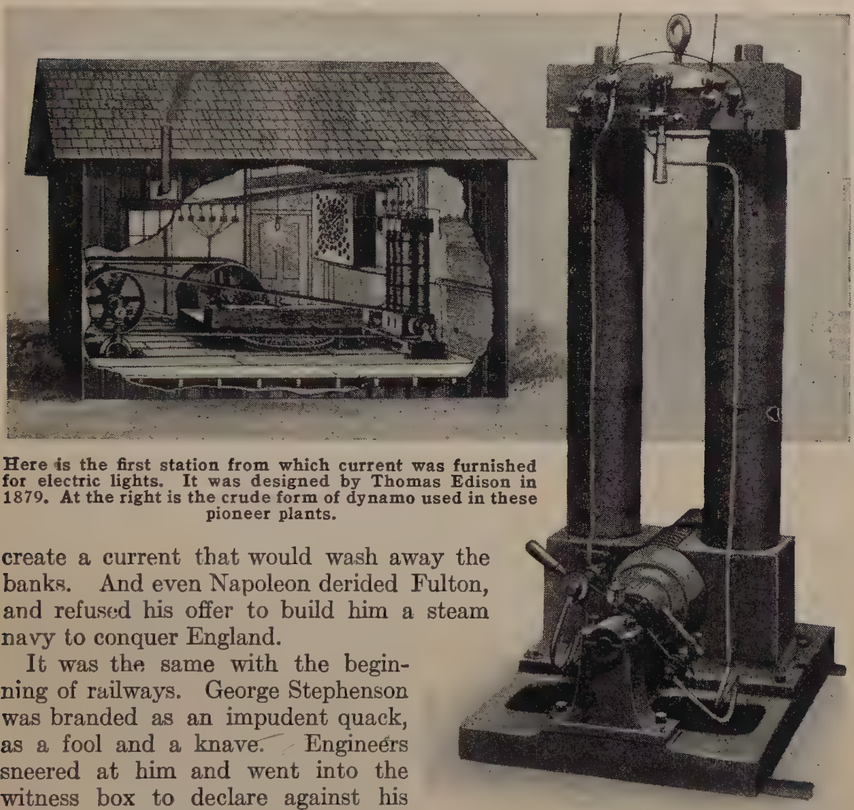
And yet the wonder of this age-long rise of man, freighted with the happiness of the race, has been the agony of it. Looking back on the history of invention, it is as if mankind has been reluctant to go forward, as if it had thrust back the cup of happiness held to its lips, as if, doubtful of its dark past, fearful of its darker future, mankind refused to tread each new path to light.

Not more than a few hundred years have passed since discoverers and inventors worked by stealth, hiding their knowledge from the world as if it were a crime. Copernicus, who proved that the earth moves around the sun, dared not publish his discovery till he lay dying. Giordano Bruno, who expanded the teaching of Copernicus, was burned at the stake in the streets of Rome. Galileo, who also taught that the earth does not stand still, was tried and imprisoned by the Inquisition. Joseph Priestley, the discoverer of oxygen, was driven from England to America because of his religious and political opinions. Harvey, who found that the blood circulates through the body, was almost ruined by ridicule and persecution. And later, when knowledge ceased to be a crime, the inventor and discoverer were forced still to work in secret by the tyranny of ignorance and neglect. Nothing is more terrible than the history of knowledge.

None of us can ever know how much of the joy of our lives was purchased for us by a heart-broken genius, crushed by a world that treated him with scorn. There is a graphic letter somewhere from Robert

Fulton, the first man to make steam navigation a success. "Never," says he, "did a single encouraging remark, a bright hope, a warm wish cross my path." A steamboat launched in Scotland before Fulton's time was allowed to fall to pieces on a canal bank because the owners of the canal declared that it would create a current that would wash away the banks. And even Napoleon derided Fulton, and refused his offer to build him a steam navy to conquer England.

THE FIRST ELECTRIC LIGHT PLANT



Here is the first station from which current was furnished for electric lights. It was designed by Thomas Edison in 1879. At the right is the crude form of dynamo used in these pioneer plants.

It was the same with the beginning of railways. George Stephenson was branded as an impudent quack, as a fool and a knave. Engineers sneered at him and went into the witness box to declare against his schemes. Farmers were told that railways would prevent cows from grazing and hens from laying; noblemen were told that the poisoned air from the engines would kill their pheasants and foxes. Householders were told that their houses would be burned up by the fire from the engines, boilers would burst and blow the passengers to atoms, landscapes would be made barren, and the canals would be reduced to unused ditches. Even the Duke of Wellington, who had won the battle of Waterloo, was afraid of railways.

When London was first lit with gas, Sir Walter Scott wrote a letter saying, "There is a madman here proposing to light London with smoke." And one of the greatest scientists then living, Sir Humphry Davy, said, "Before you can safely use a gasometer you will want a weight as big as Primrose Hill to keep it down." That was the opinion about gas, and it reminds us of a greater wonder still concerning electricity. Michael Faraday, the greatest electrician of his age, called electric light the idea of a quack, to be classed with table-rapping and other impostures!

What mighty changes men have lived to see! Contrast the introduction of gas and steamships and railways with the invention of the flying machine. Robert Fulton made his first steamboat friendless and alone; George Stephenson was denounced as an impostor. Today our inventors work with the eyes of mankind upon them, and with the applause of the world to encourage them.

It has taken hundreds of years to make men see that knowledge and invention are good for the world, and with the awakening of the world to this truth has come the transformation of human life. Napoleon came post-haste to Paris from Waterloo in exactly the same way that Constantine had come to Paris 1,500 years before. No great improvement in transit by land or sea had come in all that time.

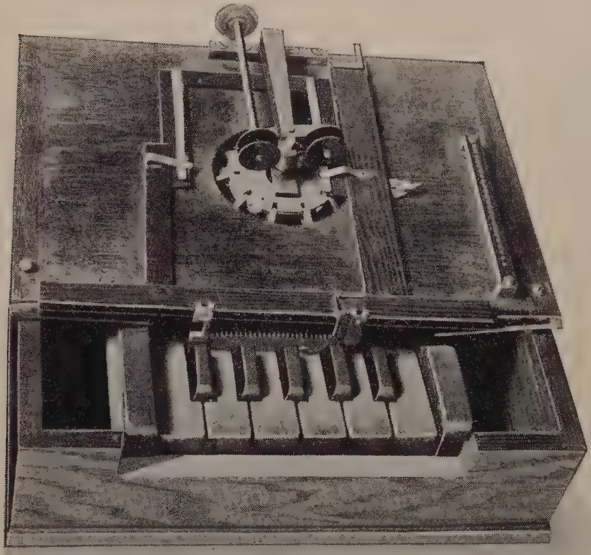
How often do we think that William the Conqueror never read a book, that Queen Elizabeth never had a watch, that Shakespeare never read a newspaper, that Cromwell never saw a photograph, that George Washington wrote his dispatches by candle-light, that Napoleon never sent a telegram or traveled in a train, that Abraham Lincoln never used a telephone?

Today man has built up knowledge so that every American boy at school may know scientific facts that Sir Isaac Newton did not know; he has built up mechanical and scientific powers that enable us, first of all the generations that have ever been, to live our lives amid inventions that abolish time and space.

"I never handle the telephone," says Sir William Crookes, "without feeling that I am handling a miracle." And a miracle the telephone is. Yet it is only one member of a family of inventions, all belonging to our own time, which are changing the face of the world forever.

It would fill this book to deal with them, but think for a moment what all these things mean. Let us imagine a man who has availed himself to the utmost of the advantages of modern science, and let us imagine him sitting at home by his fireside on any night. He is reading a newspaper telling the story of the things of the day in all the countries of the world. A bell rings; he takes up the telephone receiver and listens; it is the voice of a friend 200 miles away. A knock comes at the door; a boy hands in a wireless message from a friend a thousand miles out at sea. He reads it and sends his greeting back, straight from his fireside to mid-Atlantic. And then he picks up a book and reads what Shakespeare wrote. And then, perhaps, he may tire of his book, and he touches the switch of a phonograph, and lo! Madame Melba is singing.

THE GRANDMOTHER OF TYPEWRITERS



Although it looks like a toy piano, it is really one of the early typewriters. It was patented in 1868, and was an exceedingly awkward machine, unable to compete in speed or accuracy with handwriting.

He can have such a concert from that phonograph as has never been possible in a public hall, with an array of singers and players such as has never come together in any hall at any time. And then, when the music has stopped, he may darken his room, and have thrown on to a screen living pictures of the life of men in almost any country on the face of the earth. He may take up the portrait of a friend across the earth, and may listen to his friend's voice coming from a box. He may think of any subject in the world, and have a book upon it brought to him. He may pick up the telephone and listen to a speech in a public hall down town. It would take too long to think of even half the things that a man may bring into his life by using the "impossible" things of yesterday.

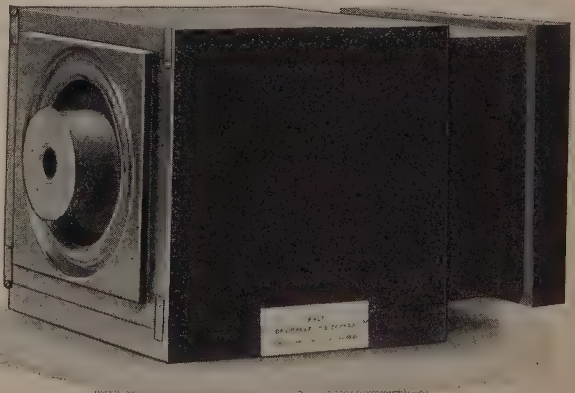
It is difficult to conceive the benefit that these inventions will bring to future ages. Let us suppose that they had been invented 300 years ago. We should have been able to see Shakespeare conducting a play, and to hear his voice. We should have been able to sit in our room and see, thrown on a screen, the living picture of Cromwell leading his troops at Marston Moor, the execution of Charles Stuart in Whitehall; we should be able to see the frightful horrors of the French Revolution reproduced before our eyes; we should be able to see Napoleon in his rise and fall. We should see the throwing over of the tea in Boston Harbor and the midnight ride of Paul Revere; George Washington and the framers of the Constitution; Abraham Lincoln walking down the streets of Washington. We should be able to sit in our room and hear Shakespeare and Milton and Cromwell speak. We should know the truth about a thousand things of which history is in doubt, and history itself, we may be certain, would have been changed on every page.

So, we may be sure, will these things change the world in the time that is coming. Nothing seems impossible to an age in which we can talk into a box and make the box talk back to us. Nothing seems impossible to men who can thrust their hands into space and bring back power, who can tap a message into the air and bid it go where they will.

What an unthinkable power is a great invention! It can never end. It knows no limit. It leads from step to step. It is like a beacon light that beckons men on from age to age, bidding them do more and more. No man can think of the World War without thinking of the great inventors. They made it possible, for good and ill; without their work that war never could have been. Think of the men whose spirits must have hovered on those battlefields. Think of that work of theirs which went on through the war. The great unseen army of inventors and discoverers—was it not there all the time?

Archimedes was there. Before Christ was born in Bethlehem he invented pulleys and windlasses and water-screws, drove great machines by compressed air, and lifted weights by hydraulic power; and there, in that appalling upheaval of the world, his levers and pulleys were working still. He loved his work, that everlasting man, and war destroyed his body as he sat thinking out a problem; but war could not destroy his mind; and when the roll is called of those who won the war Archimedes will be there.

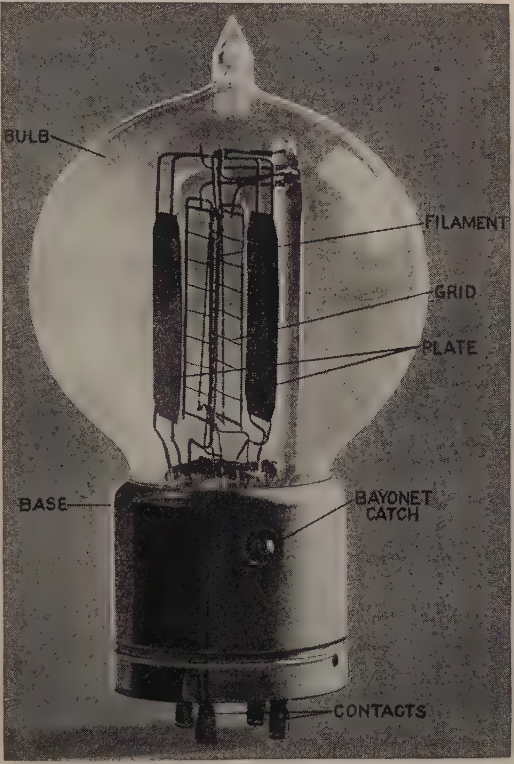
THE FIRST SUCCESSFUL CAMERA



These old "daguerrotype" photographs on copper plates were taken for the first time with a camera like this. One box telescoped inside the other for focusing.

And there was Roger Bacon, the wonder-man who stirred the vision of Columbus, the monk and thinker and inventor whose knowledge frightened men 600 years ago, who knew all about magnifying-glasses and perhaps invented gunpowder, and whose books, lying so long unknown, were revealed at last to set men thinking and inquiring into the secrets of science.

A TWENTIETH CENTURY TRIUMPH



The audion or amplifier shown above is one of invention's latest achievements. It has made wireless telephony possible and greatly extended wireless telegraphy. Its function is to detect exceedingly small electric currents and amplify them.

And surely there were on the battlefields those men who found the laws of chemistry, who probed into the heart of matter and brought its secrets out. Quaint Henry Cavendish was there, with all those gases he spent his life in finding out. Men said of him that he spoke fewer words in 80 years than any other man who had lived so long, and they might have said that he did as much work in 80 years as any other man. He solved great mysteries of heat and electricity, he studied explosions, and without the things he added to the book of knowledge we never could have won the war.

And in his steps came that long line of famous electricians in which Faraday and Humphry Davy shine like stars. Both these were there. It was Faraday, the Yorkshire blacksmith's son, who listened to Davy lecturing, who became a boy in his laboratory, and so outran his master that towards the end of his life the noble Davy said, "My best discovery was Michael Faraday." This blacksmith's son it was who laid down the beginnings of the telegraph and telephone and a thousand other applications of electricity, who began the work of steel alloys, improved optical instruments, and gave lighthouses their mighty lamps. He kept a record of all his experiments, and they numbered 16,000 when he died.

Sir Isaac Newton was there, with the laws of light behind all telescopes; and there was the spirit of Galileo, which every telescope enshrines. Brunel was there, with his great idea of tunnels, and the shield he made for boring them after watching a ship-worm at work. Lord Kelvin was there—we cannot imagine the war without those precious electrical devices, cable instruments, compasses, and mathematical calculations, which we owe to the work that this great man began in a Glasgow cellar.

The great founders of steam-power were there if any were—James Watt and George Stephenson and Richard Trevithick and Robert Fulton, who struggled against a scornful world to build up those trains on land and ships by sea which have moved these multitudes of men across the earth. And Nasmyth, his steam-hammer ringing through the arsenals, was surely at the war, with that unconquerable spirit of Joule, who defied the British Association which laughed at him, and gave us the first idea of the value of the heat produced by mechanical forces.

And surely the spirit of Wilbur Wright was there, the great American genius of human flight, the plain, lovable man who thought that one day the flying men would sweep the curse of war out of the world. There he was, with his great compatriot Edison, whose work was hardly ever for one single day missing from the field of war.

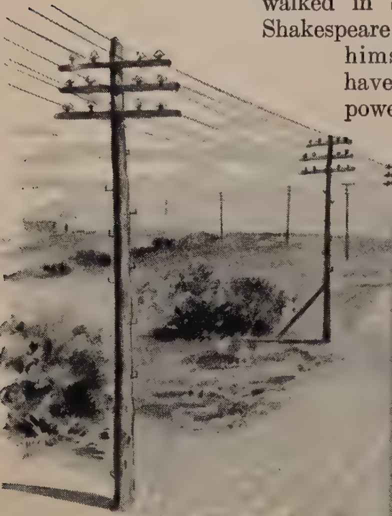
From battle-front to battle-front, across the continents and oceans, up in the air and down in the sea—there was the genius of the wireless men: of Clerk Maxwell, who laid the basis of the scientific theory, of the clever German Hertz, who first constructed apparatus to receive the electric waves; of the Italian Marconi whose practical inventions have abolished space and distance for the human voice and utterly transformed the world.

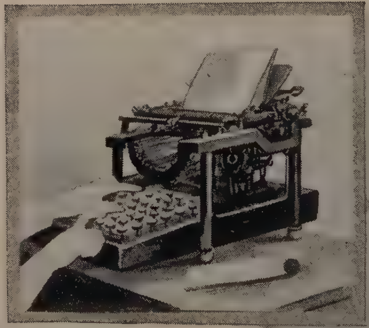
All these were there; and there, thank God! was Lord Lister, too, whose memory every wounded man must bless, whose work in antiseptic surgery goes on, and will go on through the ages, till it has saved more lives than war can take.

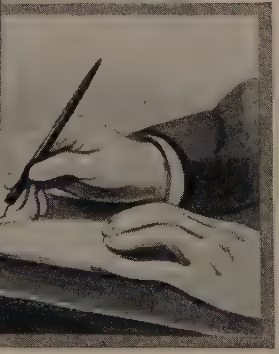
So, through the power of invention, the genius of the Past was fighting on the battlefields for human liberty; so the Past came to the aid of the Future in that great cause for which our heroes fought and fell. Invention carries on man's power from age to age; it may be said that it is making man immortal. Man, by his inventions, is making it impossible for the best that is in him to perish from the earth. Follow that thought for a moment; let us take one of those inventions through which man has carried on his power and thrown it forward into time so that it does not die with him. Take printing. By the invention of printing man has made his mind immortal, *whatever may happen to the body he inhabits or the life by which he moves.* If Shakespeare had utterly perished when he passed from this visible world, his mind could not have perished with him. It lives today as when he walked in Stratford. Had Shakespeare been with us himself he could have had no greater power than he has still. When the first man who read Shakespeare read those last words of King Lear to Cordelia, they must have stirred in him the same emotions that they stir in you and me. When Shakespeare wrote—

> There's a divinity that shapes our ends,
> Rough-hew them how we will,

he was giving the very thought that is in our minds just now to millions of people then unborn, and he will be giving this same thought to millions of people in a thousand years to come.







Here are three of the changes invention made in civilized life in the 19th century alone. The post horse gave way to the telegraph; the sewing machine did away with much of the tedious hand sewing; while the typewriter began to do the bulk of the civilized world's writing.

The days when knowledge was gathered slowly and with peril, spread from place to place by a faithful few, often at the risk of life, have passed forever, and nothing can be lost or locked up now. The Mind of Man is covering the earth. His inventions are making his mind independent of time and space as well.

Take three of these inventions only—pictures, music, and books. Who can listen to the mighty dramatization of sound that we call Handel's 'Messiah' and not feel something of the power and grandeur of natural forces? Who can look on the materialization of a vision that we call Raphael's 'Transfiguration' and not feel something of the mind that conceived it, and the spirit of the solemn scene it represents? Who can read the immortalization of piercing anguish in Mrs. Browning's 'Cry of the Children' and not feel back in another age, listening to the beating hearts and sobs of little ones whose graves have been green these 60 years? The old, old story that thrills you as you sit remembering by the fire, the book that stirs your mind and opens up another world of thought for you, the picture on the wall that grips your heart as in a vice, are instruments of the mind and soul of man working in you across the earth and through the years. They carry the mind to far-off places and to other days; a sound you heard in Egypt comes, and you are on the Nile again. They bring back memories of friends that we shall never see again on earth; they move us to gladness and tears.

And so, through ages yet to come, the songs, the books, the pictures that we know will stir the hearts of men and women, they will carry into the centuries the mind of the age that gave them birth. It will not die, and its influence will not fail. The human mind has broken down the barriers of time and space, and clothed itself with immortality.

It is one of the amazing triumphs of the mind of man that, when faced by human impossibilities, it makes a machine to do them. Man has today a million times the power he had a thousand years ago—power won from Nature, snatched from wind and river and sun. He is taking hold of the invisible powers of the world. He is harnessing natural forces to do the work his own hand cannot do. He sends his messages through the air; he hitches his engines to the rivers; he floods the dark world with light drawn from beyond the ether. Shakespeare's Puck promised to "put a girdle round the earth in 40 minutes"; man can do it now in four.

Man can photograph a thing he cannot see; he can magnify sight and speech, and can store up sound. He can run like a deer, can fly like a bird, can swim like a fish; but he can do more, for he can travel faster than a bird, by a power that he can stop with his finger, and he can cross the earth without losing touch of home. From mid-air and mid-ocean too, from down in the earth and down in the sea, he sends his message where he will. The time will come—indeed, the time is now fast coming—when man will lengthen life, but while that day waits he magnifies the work that he may do in his allotted span.

WONDER CHILDREN OF THE HUMAN BRAIN

In the air, on land, and on the sea, what wonders man's skill and invention have wrought! These things that seem so commonplace to us are fully as strange as any of the magic deeds told in the 'Arabian Nights', or in the fables of hero gods of old. What ancient dreamer could have conceived of the flying machines, the gigantic battleships firing cannon with 20-mile range, the torpedo boats talking to each other by wireless telegraph, the locomotive, the automobile, or the marvels of steel building?

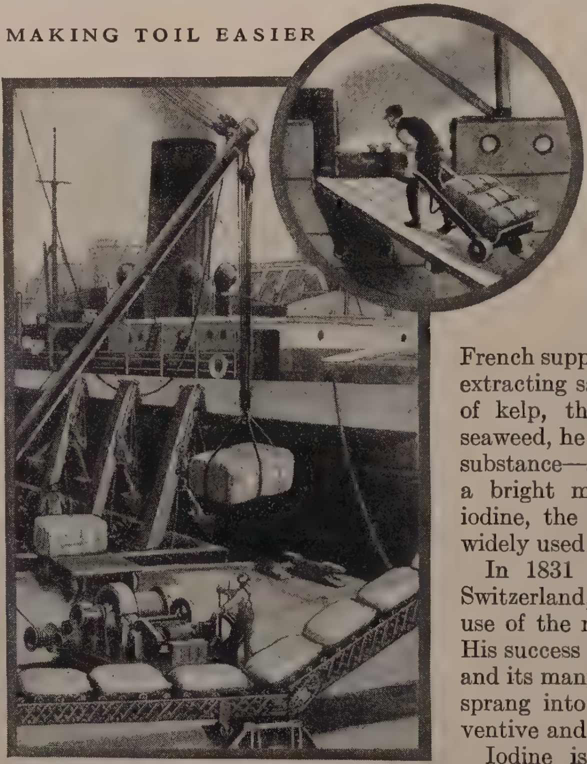
In the strict use of the word, an invention is a mechanical contrivance through which we may realize our purpose more readily than before. In the prehistoric age man invented speech, if we may call that an invention; fire, with the arts of heating, lighting, and cooking; tools, the axe, the knife, the plow, and such weapons as the bow, the sword, and the lance; pottery, wheeled carts, and boats to row and to sail. These are prehistoric inventions, which are found in many parts of the world. In some regions the following inventions had been made before the dawn of history: the smelting, working, and hardening of metals; irrigation through dams and canals; water-wheels, glass, bricks, writing, with the making of paper, etc. With the invention of writing recorded history begins.

It is remarkable that, when men had learned to write, for thousands of years they practically ceased to invent. Between 4000 B.C and 1100 A.D. no invention was made equal in importance to the above, but only improvements in minor details. Ships were made larger, clothes were made richer, but the real activity of man was directed towards the things that writing made possible — namely, society based on written law; literature, history, science, and philosophy.

The third period in the history of inventions begins with the introduction of the magnetic compass about 1200 A.D., of gunpowder about the same time, and of printing about 1450. These may have been invented in China long before, but the West discovered them independently, and made great use of them to discover America, to shatter feudalism, and to reform the church and free men's minds. Since then some of the great inventions are the telescope by Galileo (1609), the pendulum clock by Huyghens (1657), a practical microscope by Leeuwenhoek (about 1660), an improved steam engine by Watts (1769), spinning machinery by Hargreaves, Arkwright, and Crompton (1763–74), the power loom by Cartwright (1785), gas lighting by Murdock (1792), vaccination by Jenner (1796), the steamboat by Fulton (1807), the railway locomotive by Stephenson (1814), the reaping machine by McCormick (1832), the photograph by Daguerre (1839), the electric motor and dynamo by Faraday (1832), the telegraph by Morse (1844), the sewing machine by Howe (1846), the open-hearth steel process by Siemens-Martin (1866), the telephone by Bell (1876), the linotype by Mergenthaler (1884), the gas engine by Daimler (1884). Other inventions that struck out new lines were the automobile, the submarine, the airplane, the application of chemical analysis to every branch of manufacture, and the means of making exact measurements. The first decade of the 20th century saw the invention of the remarkably sensitive audion, an instrument for detecting exceedingly small electric currents (*see* Audion; Wireless Telegraph and Telephone).

The development of these fundamental inventions covers every field of modern life—the compound and turbine engine, applied to railroads and to ships, the numerous uses of gasoline engines, screw ships of iron and steel, oil and sugar refining, matches, the cotton gin, the circular saw, spring clocks, aniline dyes, spectacles, antiseptics, various serums for inoculation, galvanized iron, paper from wood pulp, machines for every purpose from the making of pins to the making of armor plate, the phonograph, the motion pictures. The list is endless and is ever growing, and at the root of practically all of these inventions lie the great advances in abstract science in recent times, made by great scientists who sought only to increase the world's stock of knowledge, without thought of practical application or hope of gain.

MAKING TOIL EASIER



Once human labor was the cheapest thing there was, and no effort was made to conserve it. But now invention bends all its resources toward reducing the necessity for manual toil, as in the case of the machinery which you see here, replacing the stevedore, with his truck.

Io. This beautiful maiden, the daughter of Inachus, king of Argos, as the story is told in Greek mythology, was beloved by Zeus (Jupiter). To protect the maiden from the jealousy of Hera his wife, Zeus changed Io into a white heifer. But Hera was not deceived and appointed the giant Argus, "the all-seeing one," who had a hundred eyes, to watch over her. Hermes (Mercury), the winged god, commissioned by Zeus to carry off the heifer, slew Argus, first charming him to sleep by playing on the flute and then cutting off his head. Hera used the eyes of Argus to decorate the tail of the peacock, her sacred bird. But the jealous goddess, not yet satisfied, sent a gadfly to torment Io, who fled over land and sea, without a moment's rest, until finally she was restored to human form.

IODINE. The insistent demand of Napoleon I for ammunition to carry on his wars was the indirect cause of the discovery of an element which has proved as great a blessing to mankind as the Napoleonic wars were a curse.

In 1812, Bernard Courtois, a manufacturer of saltpeter, one of the important ingredients of gunpowder, was working feverishly in his shop in Paris to increase the French supply of this material. While extracting salts of potash from ashes of kelp, the great nitrate-producing seaweed, he came upon a strange new substance—a grayish-black solid with a bright metallic luster. This was iodine, the chemical element now so widely used in medicine.

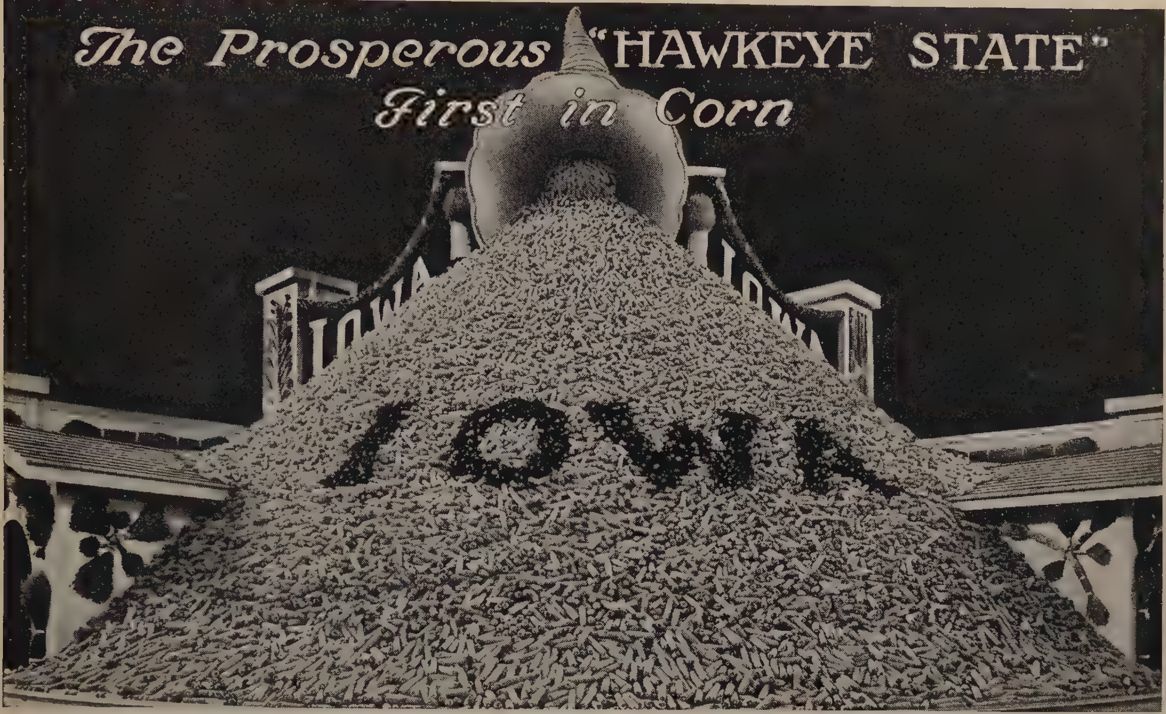
In 1831 Dr. Coindet of Geneva, Switzerland, made the first medical use of the newly discovered element. His success was so amazing that iodine and its many compounds immediately sprang into world-wide fame as preventive and curative agents.

Iodine is known in chemistry as one of the four halogens, the others being chlorine, bromine, and fluorine. Physicians use iodine and many of its compounds with other chemicals in the internal treatment of rheumatism, pleurisy, Bright's disease, asthma, goiter, bronchitis, and in chronic lead and mercury poisoning. Its chief compounds, called iodides, are formed with various metals. Iodine is used in many forms as a disinfectant and antiseptic, and is painted on wounds and bruises to relieve inflammation. The sweetish unpleasant odor sometimes encountered in hospitals is caused by iodoform, a compound of carbon, hydrogen, and iodine used in surgical dressings.

Pure iodine is a black crystalline substance which turns to a very heavy vapor at 184° Fahrenheit. Seaweed yields iodine, but the greater part of the world's supply comes as a by-product from the nitrate beds of Chile.

Iodine has important commercial uses, chiefly in making photographic chemicals and in preparing dyes. The antidote for iodine poisoning is a copious draught of starch water.

The Prosperous "HAWKEYE STATE" First in Corn



This display is a symbol of Iowa's riches. Corn—a veritable golden flood of it—is the cornerstone of the state's wealth.

Extent.—East and west, 310 miles; north and south, 205 miles. Area, 56,147 square miles. Population (1920 census), 2,404,021.
Natural Features.—Rolling prairie country. Chief rivers: Mississippi, Des Moines, Iowa, Cedar, Missouri, Big Sioux.
Chief Products.—Corn, oats, hay, and wheat; hogs and cattle; butter and eggs; coal.
Chief Cities.—Des Moines (capital, population, about 127,000), Sioux City (72,000), Davenport (57,000), Cedar Rapids (46,000), Dubuque (40,000), Waterloo (37,000), Council Bluffs (37,000), Clinton, Burlington, Ottumwa, Mason City, Ft. Dodge (over 20,000).

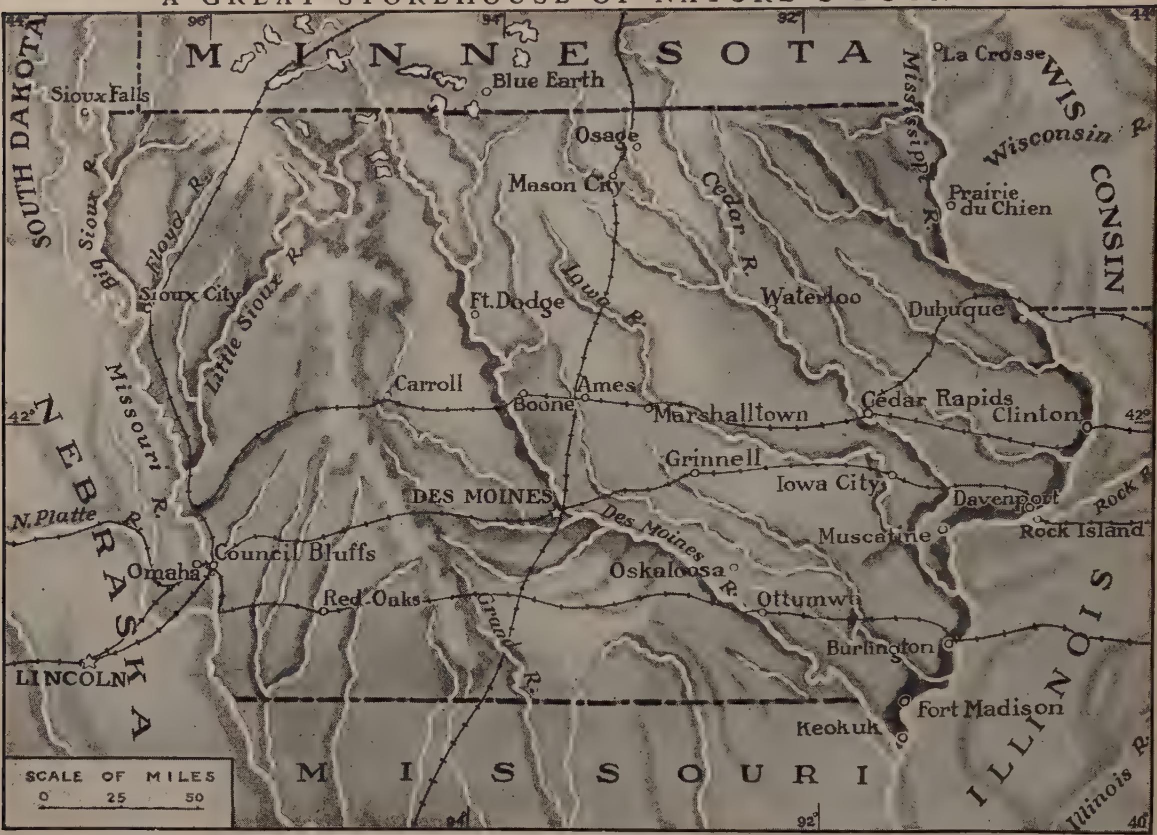
IOWA. A gigantic granary bursting with food sufficient to supply a continent; a huge storehouse of nature's bounty; a region of gently undulating farm and grazing lands teeming with yellow, waving grain—that is the state of Iowa today, barely three-quarters of a century after her forests first felt the ax of the pioneer and her fertile prairies first yielded to the shining plowshare. Iowa lies in the very lap of the richest agricultural region of the world, flanked on her eastern and western borders by imposing bluffs which during the process of erosion were left standing as ramparts against the lordly Mississippi and the turbulent Missouri. Since immemorial time these bluffs have stood guard over the broad kingdom which lies between them—a kingdom designed by nature to be the priceless heritage of those who braved the perils of wilderness and savage to wrest away its riches.

The rich black soil of Iowa, in some places several hundred feet deep, is more valuable than all the gold and silver mines in the world. Twenty-fourth state in the Union in point of area, and 10th in point of population, Iowa for years has been the foremost state in production of corn, hogs, and horses, and one of the three leading states in the number of cattle and total value of farm crops. No state has a greater proportion of farm land.

Uncle Sam has made few investments which have repaid him more richly than has Iowa. The 56,147 square miles which comprise the state's area constitute a comparatively small portion of the Louisiana Purchase of approximately 1,000,000 square miles, acquired from France at a cost of about $15,000,000. Let us say the United States paid Napoleon $1,000,000 for Iowa. Every year Iowa farmers get three times as much as that for their colts. It is barely one-twelfth of the value of the eggs in Iowa nests each year, for every month the Iowa hen pays back Iowa's original cost. Today the improved farm lands of the state, bought for four cents an acre, are worth more than $150 an acre, or more than five billion dollars all told. The value of the diversified products of these lands mounts into many hundreds of millions annually. Iowa as a state is not so very old; she has been in the Union only since 1846. Yet with her hog money alone she could float a Liberty Loan of a billion dollars, and with one year's corn crop she could build another Panama canal.

The hardy men and women, of the pure-bred American stock, who crossed the Allegheny and Blue Ridge mountains after the War of 1812, began the settlement of Iowa in the years following 1825. They had become interested in Iowa through information concerning the limitless fertility and excellence of its soil brought back by Col. Zebulon M. Pike, who had made an historic journey to the sources of the Mississippi River a few years previously. Fort

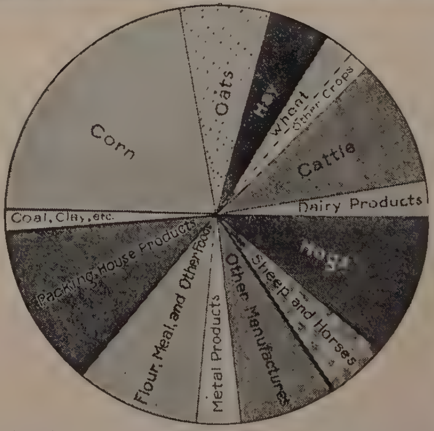
A GREAT STOREHOUSE OF NATURE'S BOUNTY

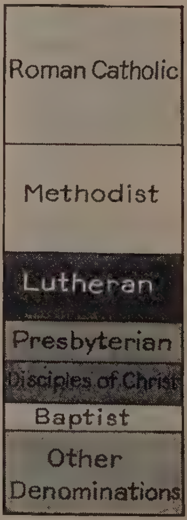


Madison, scene of much fighting in the Black Hawk War of 1832, was one of the first towns founded. Burlington and Dubuque likewise were settled early. Until recent years the increase in Iowa's population was exceptionally rapid. Iowa's wonderful farm lands are nearly all developed, about 29,000,000 of the state's 35,000,000 acres being under cultivation. The ratio of rural to urban population is larger than that of any other state. Iowa has only nine cities which possess more than 25,000 inhabitants.

Iowa's educational system is one of the finest in the country and the state's percentage of illiteracy is among the lowest, being only 1.7 per cent, compared with 7.7 per cent for the rest of the United States. The principal institutions of higher learning are the state university, at Iowa City, the State Teachers' College, at Cedar Falls, and the State College of Agriculture and Mechanic Arts at Ames. Iowa is preëminently the state of the "little red schoolhouse," there being more than 21,000 separate school buildings scattered through the commonwealth, thousands of them in rural communities and hamlets.

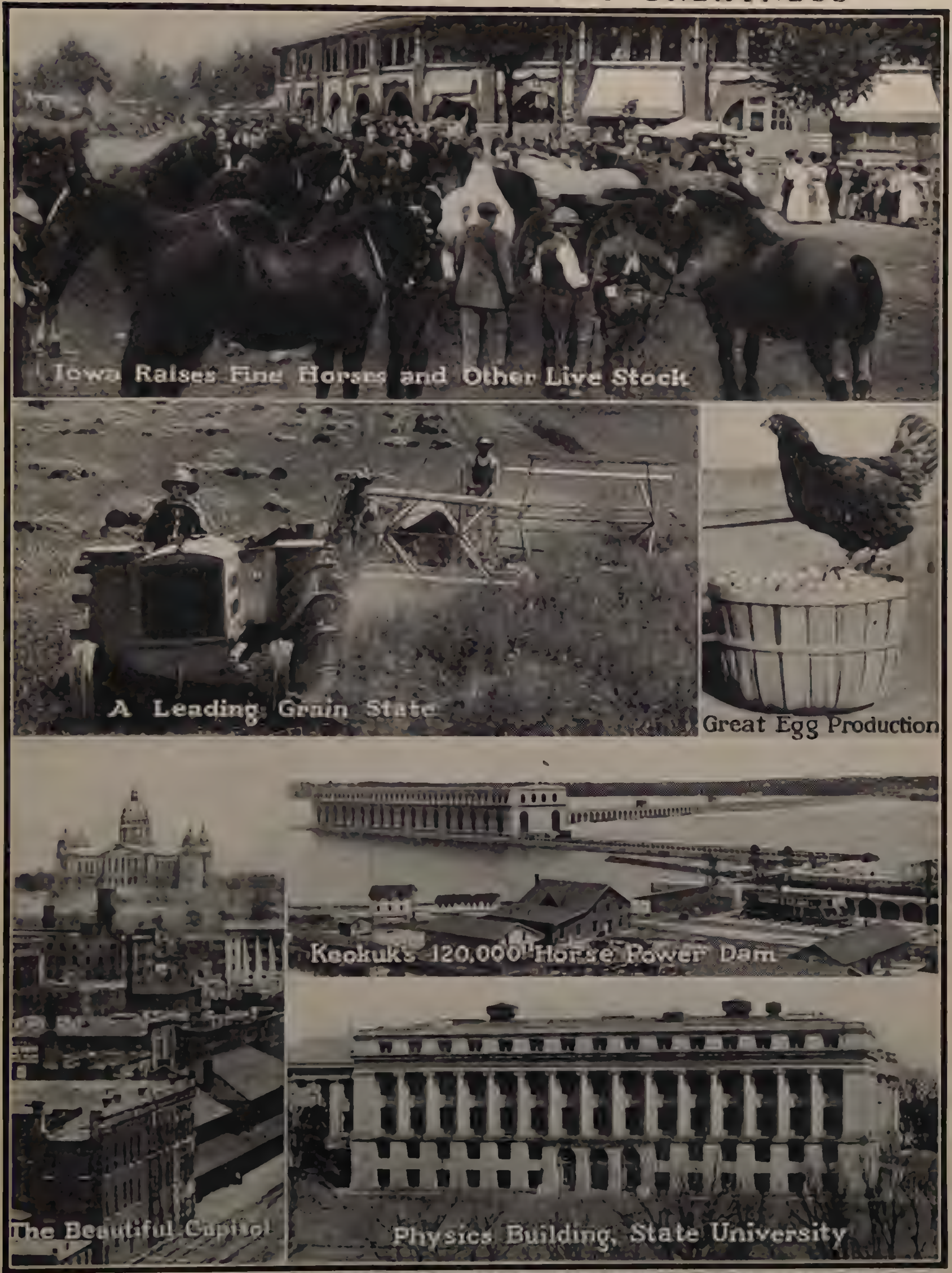
Although the romance of Iowa's meteoric growth as a center of agricultural wealth is the outstanding feature of her development, her people have made considerable strides in industry in recent decades. This has been made possible largely through the development of the large deposits of bituminous coal in the central part of the state. Another factor which is now contributing enormously to Iowa's industrial expansion is the famous Keokuk dam across the Mississippi River at Keokuk. This dam,





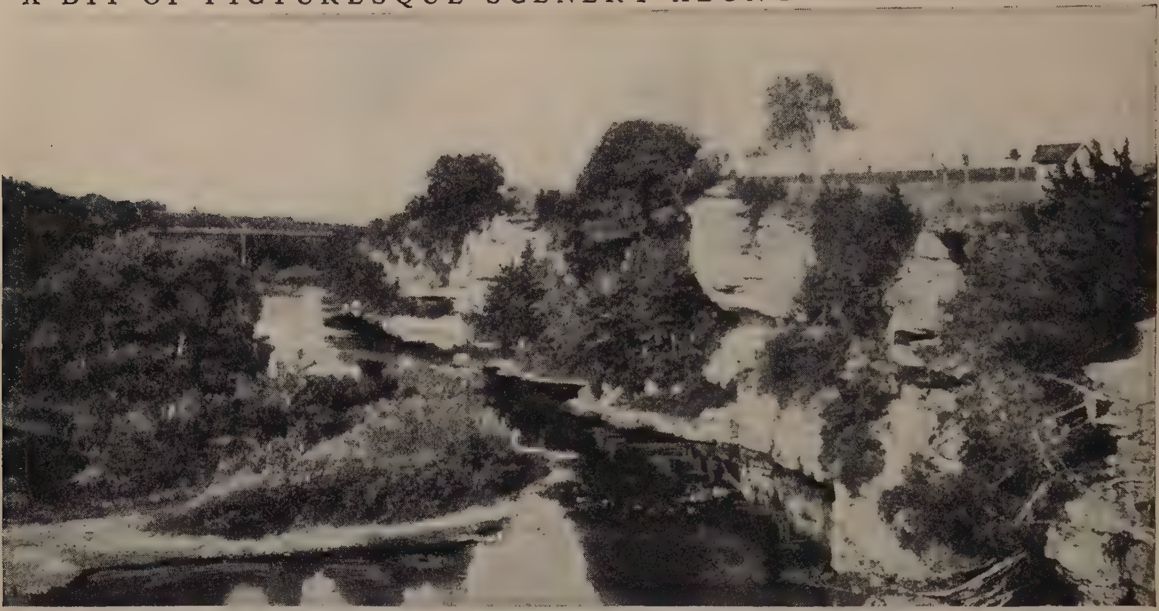
Lying between the Missouri and the Mississippi rivers, Iowa's rich black soil is watered by the countless tributaries of these great streams, as you can see on the map above. Below, the industries are compared and the division of the population according to religions is given.

PICTURE STORY OF IOWA'S GREATNESS


Iowa Raises Fine Horses and Other Live Stock
A Leading Grain State
Great Egg Production
Keokuk's 120,000 Horse Power Dam
The Beautiful Capitol
Physics Building, State University

Above are three wealth producers, and below are three uses to which Iowa has put her wealth. But they too are producers, for they return a progressive government, abundant power, and well-trained young men and women to the community, and all these increase still further the prosperity of the state.

A BIT OF PICTURESQUE SCENERY ALONG THE IOWA RIVER



The Iowa River, which flows southeastward across the state, has cut this small gorge through the limestone underlying the Iowa plain, leaving a jagged and picturesque formation, overhanging the peaceful waters. Here trees and bushes have taken root, producing a scene which is typical of most of the river valleys of the state. On the gently sloping land above are situated the fertile farms.

one of the longest in the world, was completed in 1913 by a private water-power company, and is regarded as a remarkable feat of engineering. It is 1¾ miles long, cost $10,000,000 to build, and generates 120,000 horse-power in its score or more of turbine generators. It supplies electric current to St. Louis, 145 miles away, and also to many smaller cities. By means of a lock steamboats are raised 40 feet to the level of the river above the dam.

Many Industries of the "Hawkeyes"

Meats, butter and cheese, flour and grist mill products, lumber and timber products, foundry and machine shop products, and farm implements are among Iowa's principal manufactures.

A picturesque industry, and one which is attaining much commercial importance, is that of fishing for mussel shells for the manufacture of pearl buttons. At night one may catch a glimpse of the lonely mussel fisherman in his flat-bottomed scow, dragging the river's bottom by the dim light of the moon. Millions of mussels have been hauled up from the muddy depths of the Mississippi to be fashioned into pearl buttons, and not a few fortunes have been made by mussel fishermen lucky enough to find valuable fresh-water pearls in their catches. Some of these pearls are nearly flawless and bring large sums. The course of the Mississippi abounds in button factories, an industry which has sprung up only in recent years to utilize the supply of mussels.

Like all regions situated in the midst of a vast inland territory the climate is typically continental in extremes of heat and cold. Government records for 26 years show a maximum range of 160 degrees, from 113 degrees above zero to 47 degrees below. The annual precipitation is well apportioned to bring the best results for crops, with 80 per cent of the rainfall coming during the crop-raising months from April to October.

The name Iowa is derived from an old Indian word signifying "sleepy waters," and was first applied to the Iowa River. The state received its nickname, the "Hawkeye State," in the halcyon days of the Burlington *Hawkeye*, one of the famous newspapers in the early history of American journalism.

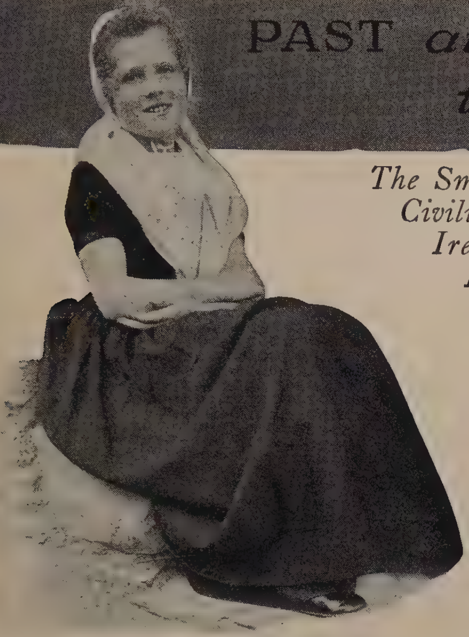
The French explorers Marquette, Joliet, and Hennepin touched the borders of the state in the latter part of the 17th century. A hundred years later (1788) Julien Dubuque obtained from the Indians the present site of Dubuque and established a trading post and lead mine there, but this enterprise was abandoned in 1810.

Iowa's Progressive State Policies

Probably in no way is the alert progressiveness of Iowans and their wideawake receptiveness to new ideas better shown than in the political history of the state. As far back as before the Civil War, Iowa was one of the first and most enthusiastic states to champion the cause of the abolition of slavery, and more than 75,000 of its men, one-tenth of the population, fought for the North. Iowa was one of the first states to enact a prohibition law, in 1884, and Des Moines was the first important city in the country to adopt the commission form of government. Iowa also was a pioneer among the states in adopting direct primaries, having passed such a statute in 1907.

The broad prairies of Iowa are traversed by about 10,000 miles of railroads and 500 miles of interurban roads, only three states having a greater mileage.

PAST and PRESENT of the EMERALD ISLE



The Smiling Sister Island of Great Britain—Its Early Civilization and Conversion to Christianity—How Ireland was Conquered and Oppressed by the English Kings—The Long Struggle for Self-Government—The Irish Free State

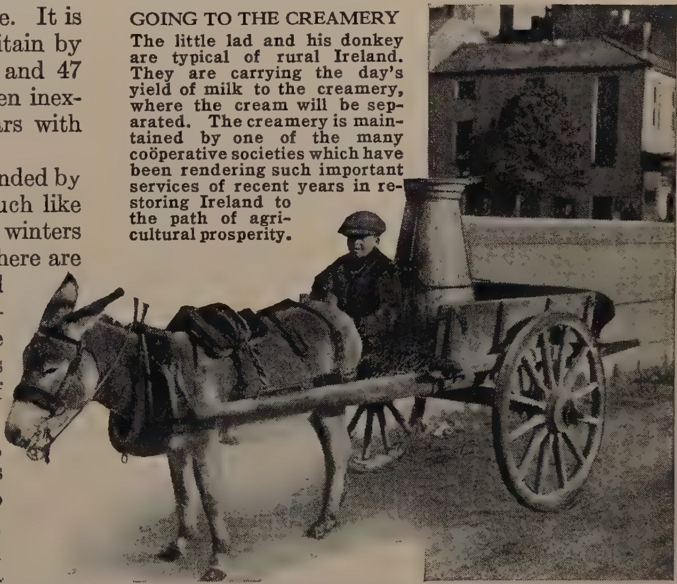
IRELAND. A romantic history, scenic beauty, the charm of a warm-hearted and impulsive people, numerous ties of blood and sympathy, and political problems of world interest give to Ireland an importance out of all proportion to its 32,531 square miles of area—about the size of the State of Maine. It is separated from its sister island of Great Britain by only 13 miles of water towards the north and 47 miles in the south, and its fortunes have been inextricably entangled for more than 1,500 years with those of its Anglo-Saxon neighbor.

In surface Ireland is an inland plain, surrounded by a rim of low mountains. The climate is much like that of England, mild and temperate, but the winters are even warmer, and there is more rain. There are numerous rivers, of which the Boyne and Liffey in the east, the Barrow and Blackwater in the south, and the Shannon in the west are most important. Lough Neagh is the largest of the lakes, and the Lakes of Killarney in the south the most beautiful.

The population is of "Mediterranean" stock, according to anthropologists, and represents two waves of Celtic-speaking peoples who came by way of England from the Continent. About 74 per cent of the people are Roman Catholic. While the northern counties (Ulster) are predominantly Protestant (mostly Presbyterian), the western and southern counties are nearly altogether Catholic.

Historic antagonisms even more than religion separate the Protestant Ulstermen from the Catholic south. Economic differences also serve to divide the unhappy island. The Ulstermen are hard-headed men of business whose trade and manufactures have enriched their part of the country. They are accustomed of old to hold most of the political positions and to play the part of a ruling class. The south, on the other hand, is made up of a Catholic peasantry who, perhaps because they have long been overtaxed renters, are less progressive than their neighbors to the north. They cherish old traditions and old grievances; but they are essentially a kindly, generous, and talented people, with a wealth of imagination and poetry in their make-up.

The land in Ireland is mostly leased in small holdings, averaging not more than 28 acres to a farm. The soil in most places is thin, and the rainfall so heavy that not much grain can be raised. Most of the country is given over to grass-land, more than in any other part of Europe. In consequence cattle-raising and dairying are widespread. Eggs, milk, and cheese are exported to the London market. Potatoes are the staple crop and food of the peasantry, and the years of potato blight have always been years of famine. The climate makes the raising of flax profitable, and much of the north is given over to this crop which partially supplies the linen manufactures of Belfast. There is almost no iron or coal in the



GOING TO THE CREAMERY

The little lad and his donkey are typical of rural Ireland. They are carrying the day's yield of milk to the creamery, where the cream will be separated. The creamery is maintained by one of the many coöperative societies which have been rendering such important services of recent years in restoring Ireland to the path of agricultural prosperity.

A PEASANT FARMER'S COTTAGE ON THE "OLD SOD"

The Irish countryside is dotted with thatched cottages of rough stone like this one. Their white walls stand out sharply against the green of the fields and the gray of the rocky hills. In one end dwells the farmer with his family and in the other the pigs are sometimes quartered.

country and little water-power. This had proved a great handicap, but nevertheless for a century past there has been a development of industry, and the busy linen and ship-building industries of Belfast are world famous.

The basic economic trouble of Ireland has been that it has never had either the agricultural or mineral resources to support a large population. The peasant has lived close to the margin of existence and has never been able to hope that he could be much better off. Until a recent date he has received little sympathy from his landlord, who often lived a long way off in England and was chiefly interested in getting as much rent from his estates as he could.

The history of Ireland is a history of conquest and oppression by the English. Englishmen would be the first to say that Ireland is the worst blot on their record. The early history of Ireland before the English migration is a time to which the Irish love to look back. While the Saxon invaders of the larger island were still barbarians, Ireland for a time possessed one of the most advanced civilizations in western Europe. This was the time of St. Patrick (died 461 A.D.) and of a flourishing Irish Celtic Christianity. Henry II, one of England's great kings, conquered the Irish in the latter part of the 12th century. But only the eastern part of the island was much affected by English institutions, or for centuries adopted the English language. The rest of Ireland was long given over to clans who warred with one another and with the English. Irish customs even invaded the "English Pale" about Dublin, and within a few generations English settlers within the "Pale" tended to become Irish in outlook and sympathy. The religious Reformation, which left Ireland unchanged in its Catholic faith while England broke with the Pope and set up a national church, still further widened the breach.

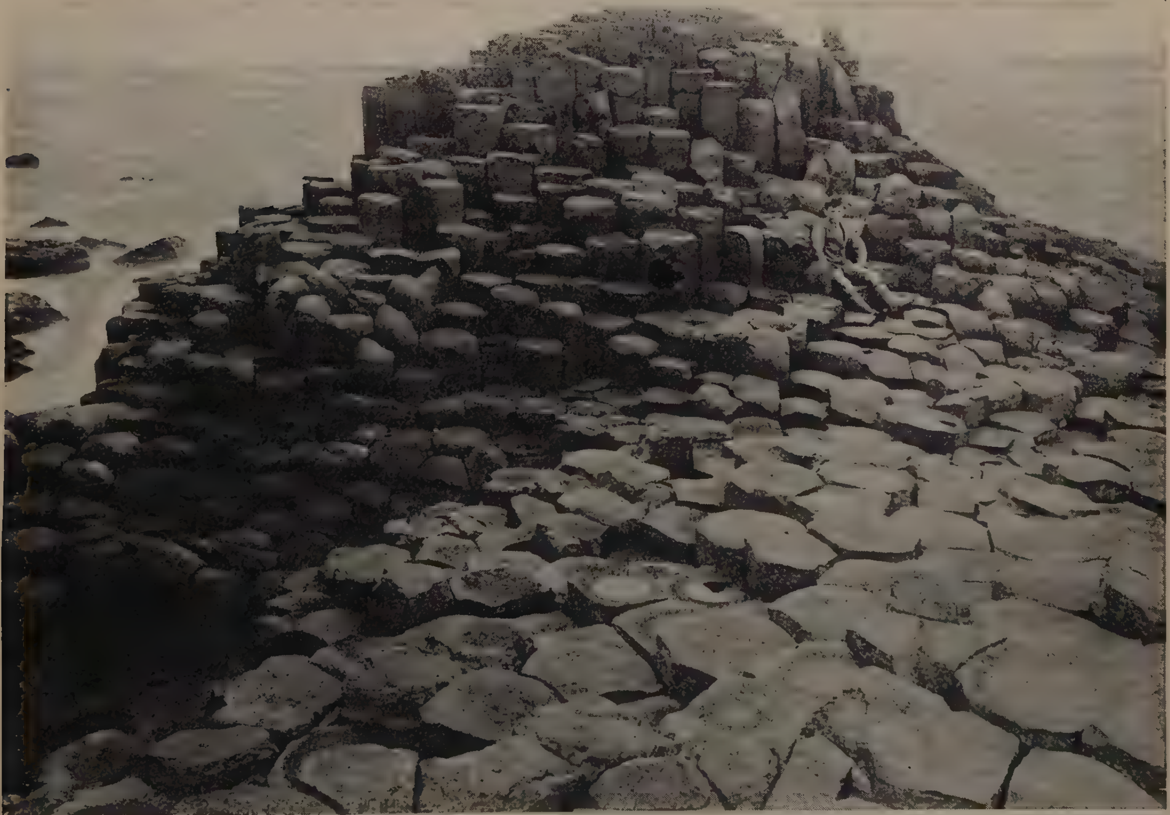
THE CROSS OF KELLS

This is one of the famous ancient crosses set up by the early Irish Christians. It is at the market town of Kells, forty miles northwest of Dublin.

The Tudor sovereigns began in the 16th century the policy of enlarging English influence by settling large "plantations" of English and Scots in Ireland, dispossessing the Irish tribesmen from their land and driving them into the west. Further dispossessions went on under the first Stuarts, and whole tracts of north Ireland were taken from a desperate peasantry, to be given to Scottish intruders. Then, when Charles I of England had his hands full with the mutinous Long Parliament, Ireland rebelled and put to death thousands of Protestant settlers (1641). Oliver Cromwell reconquered the country and with such rigor that his name remains a byword there. More land was taken from the peasants to be distributed among the English.

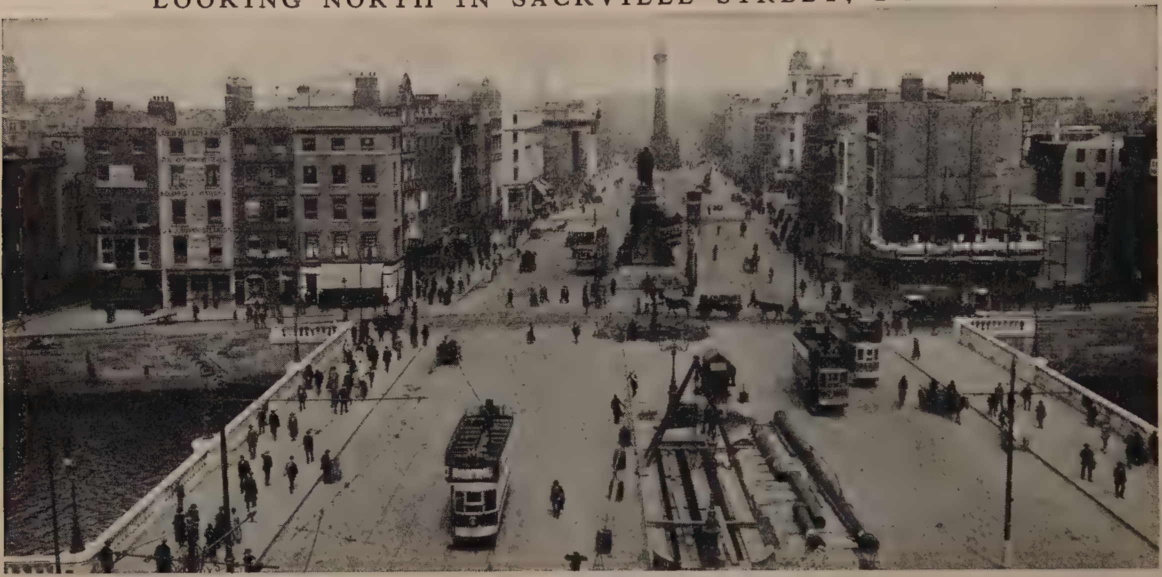
BITS OF IRELAND, NORTH AND SOUTH

Here is one of the famous Irish jaunting cars, with its side seats over the wheels, coming down the river road near Skibbereen, at the extreme southwest point of Ireland. As you can see from the smiling country-side and the stone bridge, this part of Ireland deserves its reputation for picturesque beauty.



This view shows a bit of the Giant's Causeway, on the north coast of Ireland. The boy is sitting in what is known as the "Wishing Seat," and tradition says that a wish made while sitting there will come true. Notice the remarkable structure of the rocks which make up the causeway. They are six-sided columns of basalt, set close together exactly like a pack of lead pencils.

LOOKING NORTH IN SACKVILLE STREET, DUBLIN



In the foreground is the O'Connell bridge over the River Liffey. At the end of the bridge, Sackville street, the principal street of the Irish capital, begins and runs north. Just beyond the end of the bridge is the O'Connell monument, and farther north you see the famous Nelson monument. The building with the pillars, which projects into the street on the left-hand side between the two monuments, is the Postoffice. Sackville Street is sometimes also called O'Connell street.

Then when James II was driven from England in 1688, Ireland supported him because of his efforts in behalf of the Catholic religion. But with the aid of the Protestant north and an English army, William of Orange—who had become William III of England—defeated James at the famous Battle of the Boyne (1690). This meant the triumph of Protestant Ulster, or the "Orangemen," who for a century and a half then held almost all power in Ireland. Catholics were debarred from voting or holding office, and even from educating their children in their own religion. Catholic church services were forbidden under penalty of death. The result of such persecution was to intensify the Catholicism of Ireland and to sow broadcast the seeds of lasting bitterness.

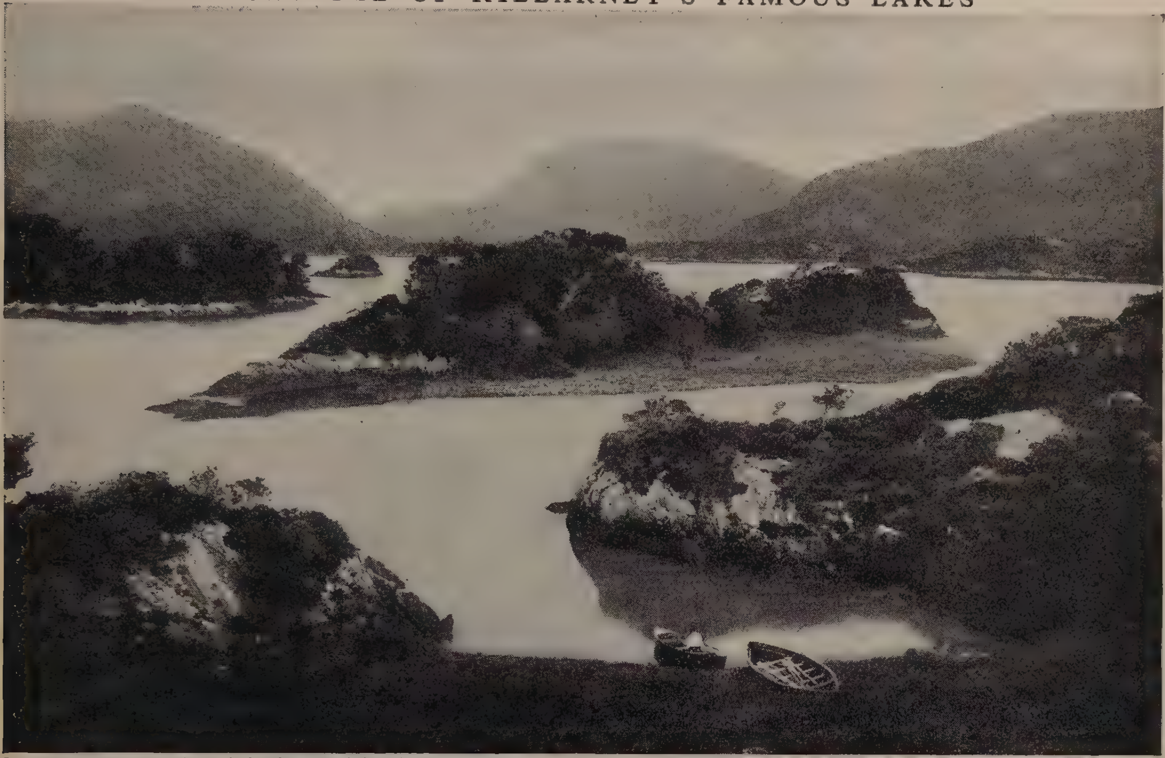
At the very end of the 18th century Ireland was bribed into giving up its separate Parliament by the Act of Union with Great Britain (1800), but thenceforth it had representatives in the British House of Lords and House of Commons. In 1829 the last of the important laws against Catholics—excluding them from Parliament—was repealed (*see* O'Connell, Daniel).

Next, in 1845 a blight destroyed the potato crop, and there followed the terrible sufferings of the famine years 1846–47. England suspended and then repealed the "Corn Laws" which hindered the free importation of grain, but thousands died, and millions emigrated. From that time on the people have been leaving Ireland for other lands, until today it is said that there are four times as many Irish in America as in Ireland itself. Before the great famine Ireland had a population of more than 8,000,000, but today its people number only about half what they were some 80 years ago.

THE SEAT OF THE "BLARNEY STONE"

This is the famous Blarney Castle, near the city of Cork. As you doubtless know, there is a stone set in the wall of the building, which according to tradition confers remarkable powers of persuasion upon anyone who kisses it. The Castle was built in 1449 by Cormac McCarthy.

A GLIMPSE OF KILLARNEY'S FAMOUS LAKES



Here you see a portion of the famous lakes in the southwest of Ireland. The lakes lie in a beautiful natural basin, hemmed in by mountains, and are studded with finely wooded islands, many of them crowned with picturesque and historic ruins.

The last part of the 19th century saw a belated effort on the part of English statesmen to undo old wrongs in Ireland. A law passed by Gladstone (1869) forced the English church in Ireland to give up its position as a state church. The rights of tenants were safeguarded (*see* Parnell, Charles Stewart) and money was spent freely to develop the resources and farming of Ireland and to enable the peasants to purchase their holdings. In 1886 and 1893 Gladstone attempted to restore Home Rule to Ireland, but even his great name could not carry the measure through Parliament. In 1898 the Conservative party gave Ireland a great measure of local self-government, and many other measures helped to improve social and economic conditions.

But the Irish continue to demand Home Rule. In 1912 Asquith brought into Parliament the third Home Rule bill, in spite of the Conservative party cry that "Ulster will fight, and Ulster will be right!" Ulster feared that an all-Irish Parliament would discriminate against its religion and against its industry, and Ulster disliked also to give up its privileged position in Ireland. In spite of "gun-running" and open preparations for armed rebellion by Ulstermen, the Home Rule bill became a law, just as the World War broke forth in the summer of 1914. Its operation was necessarily postponed during the war, and John Redmond, the conciliatory leader of the Irish Nationalists, died in 1918 with Ireland's hopes unfulfilled.

The attempt of Sir Roger Casement to bring German aid to Ireland (for which he was condemned and shot) and the ruthless trial and execution of 14 leaders of the unsuccessful Easter Rebellion of 1916, further widened the breach between England and Ireland. Leadership more and more fell into the hands of the Sinn Fein (*shĭn fān*, meaning "ourselves alone"), an Irish revolutionary party which proclaimed Irish independence, organized an Irish Parliament (Dail Eireann), and demanded the recognition of an Irish Republic. A reign of terror followed, with arson and assassinations on one side, and high-handed reprisals on the other. In 1920 a new Home Rule bill was passed by Lloyd George setting up separate legislatures in Northern Ireland and Southern Ireland. The Ulster Parliament was opened in 1921, but Sinn Fein refused to accept the act.

After lengthy negotiations between Sinn Fein delegates and members of the British Cabinet a treaty was signed (December 6, 1921) giving Southern Ireland full dominion status in the British Empire, under the name of the Irish Free State. This treaty was duly ratified and the Free State was formally inaugurated December 6, 1922. De Valera, the Sinn Fein president, refused to recognize the new government and began what was virtually civil war. In this struggle many of the leaders on both sides were assassinated or executed, among them Michael Collins, chairman of the provisional government.

The FAIRY CALF of TIPPERARY

"Looking up he saw a great black cat standing between him and the moon, on the tip of its claws, with its back up, as it mewed with the voice of a watermill. Pretty soon the cat swelled up . . ."

IN Tipperary is a hill shaped very much like a peaked nightcap. Near the top of it is a pasture where once upon a time a herdsman watched over his cows. Now this hill had long been a playground for the fairies and they loved it for the velvety grass and the broad-leaved bushes on which they could dance. The Little People were angry indeed when cows trampled on it and ate the green carpet right off their play place. Even the lowing of the herd sounded sad in their ears. Something had to be done about it or the fairies would have no spot to meet on moonlight nights. So the Fairy Queen decided to frighten away the stranger and the great beasts with long horns, sharp hoofs, and bells that sounded like big church bells to a fairy.

Night after night while the moon shone brightly on the hill the Fairy Queen would suddenly bob up before the lonely herdsman, now in one frightful shape and now in another. For a Fairy Queen can do just such things. Sometimes she would be a great horse with eagle wings and a dragon's tail; then quick as a flash she would turn into a little lame man with a flaming bull's head. Then she would be a terrible ape with a turkey's tail and duck's feet, with such roaring, hissing, bellowing, or howling as was never heard in this world before or since. And the poor herdsman, who could neither stir nor close his eyes, had to watch these horrible sights until his chattering teeth almost fell out of his mouth, and his hair lifted his hat almost half a foot from his head. And the poor cattle scrambled about like mad until the sun rose over the hill. Then the Fairy Queen would go away.

Never a night passed but that the same thing happened. The cattle, half-mad, kept falling into pits or tumbling into the river. And no herdsman would tend them at night, even when the farmer who owned them offered ever so much money. But the fairies were happy, for now on moonlit nights they could come back to dance and gambol, to sip dewdrops from acorns, and to spread fairy feasts on the heads of mushrooms.

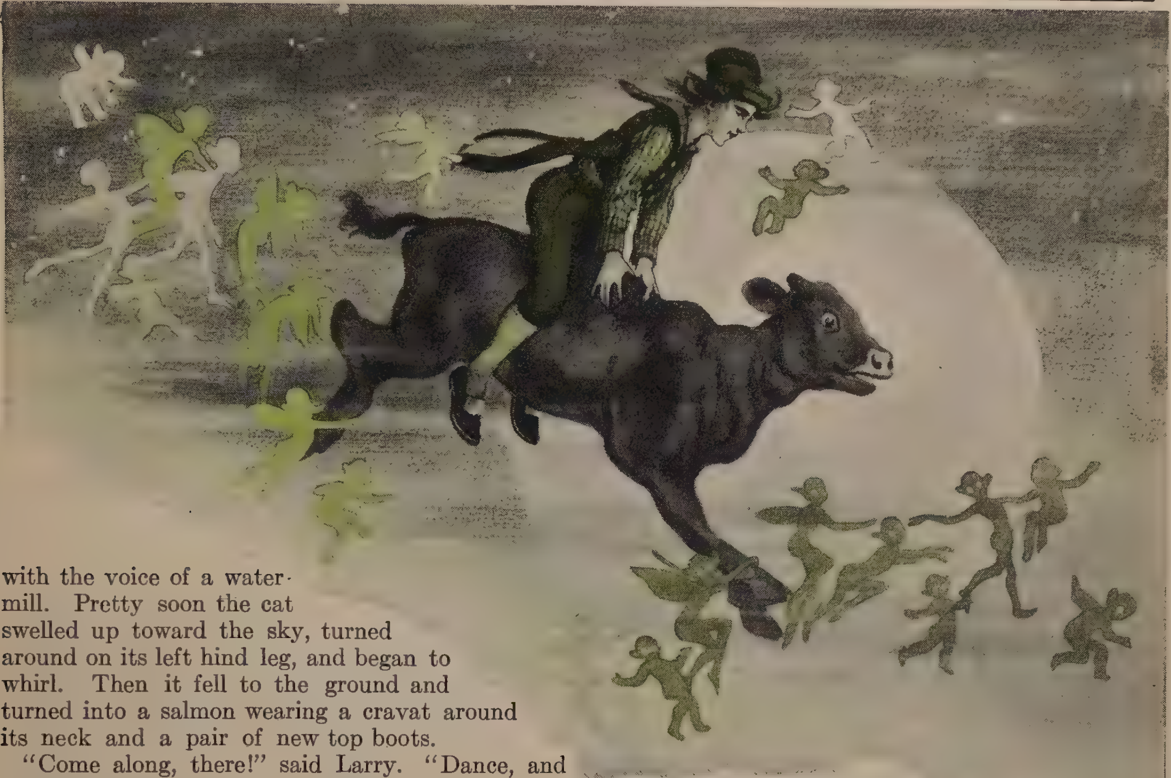
One day the farmer told his troubles to Larry Hoolahan, who feared nothing, and who played on the pipes better than any other player in all Ireland roundabout.

"Shure, an' if that is what ails you," said Larry, "just make your mind aisy. Were there as many fairies there as potato blossoms in Tipperary, I would not fear to face them. A quare thing, it would be if I who never feared a grown man should run from a fairy brat not the bigness of a thumb!"

"Whist, Larry," said the farmer, glancing cautiously around him, "do not talk so bold! But if you watch my herds for a week on yonder hill you shall sup from my broth until the sun has burned itself down to the bigness of a farthing rushlight."

After striking the bargain, Larry hurried to the hilltop just as the moon was beginning to peep over its brow. Seating himself on a big stone with his back to the wind he began to play on his pipes. Presently Larry heard the voice of fairies upon the breeze, and one of them saying with a laugh: "What! Another rash man upon our fairy ring! Go, Queen, and make him repent!"

Then Larry felt them flying past his face like a swarm of midges, and looking up he saw a great black cat, standing between him and the moon, on the tip of its claws, with its back up, as it mewed



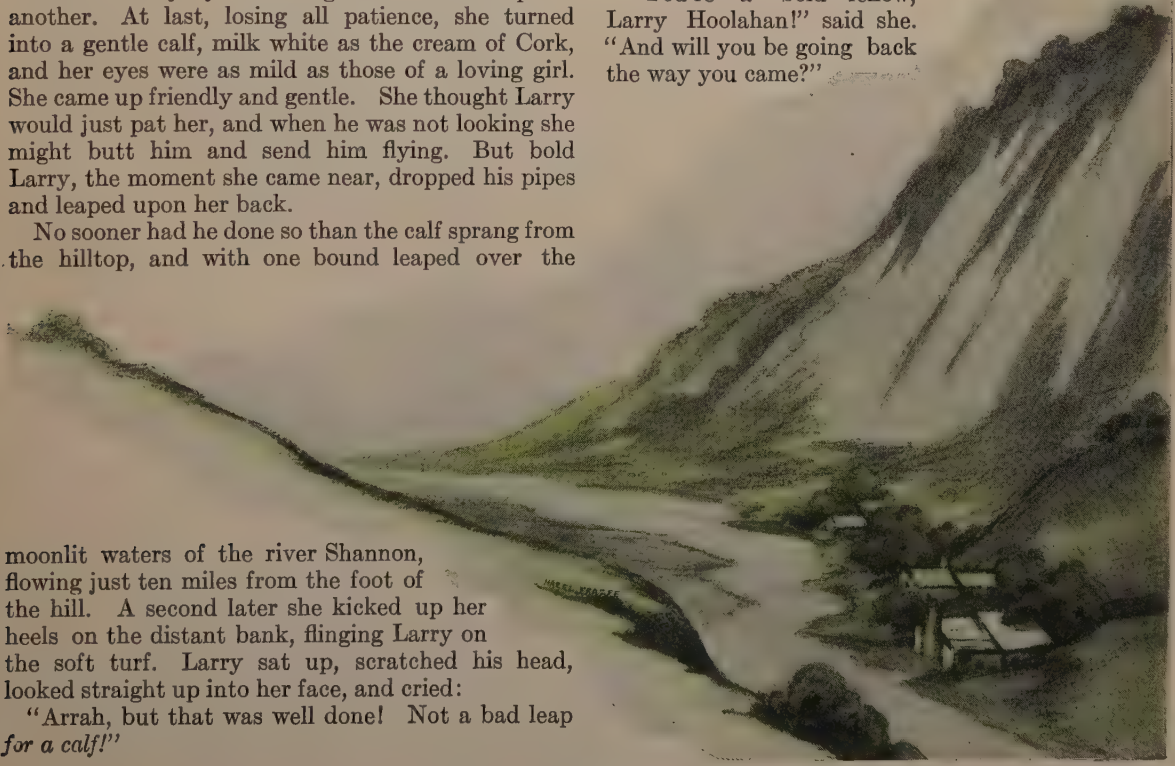
with the voice of a water-mill. Pretty soon the cat swelled up toward the sky, turned around on its left hind leg, and began to whirl. Then it fell to the ground and turned into a salmon wearing a cravat around its neck and a pair of new top boots.

"Come along, there!" said Larry. "Dance, and I'll pipe!"

And he began to play as well as he knew how, while the Fairy Queen changed from one shape to another. At last, losing all patience, she turned into a gentle calf, milk white as the cream of Cork, and her eyes were as mild as those of a loving girl. She came up friendly and gentle. She thought Larry would just pat her, and when he was not looking she might butt him and send him flying. But bold Larry, the moment she came near, dropped his pipes and leaped upon her back.

No sooner had he done so than the calf sprang from the hilltop, and with one bound leaped over the moonlit waters of the river Shannon, flowing just ten miles from the foot of the hill. A second later she kicked up her heels on the distant bank, flinging Larry on the soft turf. Larry sat up, scratched his head, looked straight up into her face, and cried:

"Arrah, but that was well done! Not a bad leap *for a calf!*"



The calf looked at him, then turned into the Fairy Queen.

"You're a bold fellow, Larry Hoolahan!" said she. "And will you be going back the way you came?"

"That I will, if you'll let me!" cried Larry. So the Fairy Queen changed into a calf again. Larry leaped upon her back. Another bound and they were on the hilltop once more.

"Much courage have you shown, Larry Hoolahan," said the Fairy Queen, again changing into her own shape. "And never more shall you be troubled by me or my fairies, while you keep the herds on this hill. The day now dawns, but if I can ever serve you, let me know." Then she vanished.

During Larry's lifetime she never visited the hill again. And Larry, piping, eating, drinking at the farmer's expense (and now and then watching the herd), never bothered the Fairy Queen with requests. At last he died, and was buried in the green valley of Tipperary. But whether the Little People came back to the hill after his death, is more than I can say.

IRIS. The bright colored flowers of the larger blue flag are found in the early summer swaying in the breeze on their long slender stems along the banks of the rivers and lakes from the Atlantic coast to the Mississippi River. Longfellow says of them:

> Born in the purple, born to joy and pleasance,
> Thou dost not toil nor spin,
> But makest glad and radiant with thy presence
> The meadow and the lin.

Although the flag, which gets its name from the fact that it sways in the breeze like a banner, is the most common form of the iris found in America, there are 170 species, ranging in color from white and yellow to deep blue and purple. Indeed, to its varied and showy hues the flower owes its name, for Iris was the Greek goddess of the rainbow who carried messages between the gods and men.

From a white form of the iris which grows in southern Europe was derived the heraldic device of the fleur-de-lis, which Louis VII of France adopted in the 12th century as the emblem of the French royal house. The fragrant orris-root, much used in making tooth powder and pastes, is derived from the rootstocks of the Florentine species.

The flower of the iris has a petal-like division consisting of three distinct sets of three petals each. The long narrow pointed light green leaves and the flower stems each bearing a single blossom rise from a rootstock which is covered with numerous fibrous rootlets. The iris grows wild in damp, fertile places, but many varieties are cultivated and grow well in good free garden soil. The favorite species in cultivation is the Japanese iris (*Iris laevigata*), and the most common wild varieties are the larger blue flag (*Iris versicolor*), and the slender blue flag (*Iris prismatica*).

IRISH LITERATURE. For centuries before English became the dominant language in the British Isles, and for centuries after, the people of Ireland spoke and wrote a language of their own. This language, known as Irish Gaelic, is a sister tongue of Scotch Gaelic and Manx (spoken on the Island of Man), and belongs to the Celtic branch of the Indo-European family (*see* Philology). It is a highly inflected tongue, rich and varied in its forms. Its nearest relatives are the so-called "Brythonic" languages, including Welsh, Cornish, and Breton.

In this beautiful ancient language the imaginative Celts developed an extensive literature long before the Anglo-Saxons, the Germans, the Scandinavians, and the other peoples of western Europe. Their stories of gods and heroes—of Cuchulain and his brave deeds, of the fair Deirdre and her sorrows, of Finn and Ossian, of the Shee (fairies) and other supernatural beings—were handed down by word of mouth, as among all primitive peoples, for generations before they were put in writing. The earliest manuscripts have long since perished, but some have been found dating from the 7th century. The most celebrated story of Irish antiquity is the epic or saga called the 'Táin Bó Cúalnge' or the 'Cattle-Raid of Cooley', in which the youth Cuchulain, champion of Ulster, is represented as holding at bay single-handed the allied forces of Ireland. This curious old tale, like many others of its kind, is written in prose, interspersed here and there with verse.

Wit and Fancy; Joy and Sadness

Because of their isolation in the early years of their history, the Irish were able to develop a highly individual language and literature. In it they expressed their love of nature, their mysticism and dreamy fancy, their melancholy and joy; their intense love of country, and their inimitable wit and humor. In the course of the 19th century the old national tongue fell into disuse and almost died out, but of recent years persistent efforts have been made to restore it as both a literary and a spoken tongue, largely through the efforts of the Gaelic League, organized in 1893.

There had already sprung up a new Irish literature, written in English but preserving the Irish spirit and making use of the Irish traditions. At the opening of the 19th century came the 'Irish Melodies' of Thomas Moore; then a little later the beautiful lyrics of James Clarence Mangan, Sir Samuel Ferguson's 'Lays of the Western Gael', and many others. In fiction there has been a long line of brilliant writers, of whom Samuel Lover (1797–1868) and Charles Lever (1806–1872) are the best known.

The Irish Literary Revival

In the last generation there has been a powerful movement, known as the Irish Literary Revival, to create a distinctively national Irish literature. Among the chief figures in this revival are William Butler Yeats, who in his poems, dramas, and essays has brought back much of the magic beauty of Celtic legend; and George W. Russell ("Æ"), another mystic poet and essayist who finds in the ancient lore of his native land "the music of an eternal joy." Lady Augusta Gregory, through her practical ability as well as her literary talent, has done much to make the Irish Literary Theatre (founded in 1899) a success. John Millington Synge, whose early death cut short a career of splendid promise, was the dramatic genius who got closest of all to the soil of Ireland and who came nearest to depicting the heart of the Irish peasant. (*See* Drama.)

Hilda Hanway

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